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TITLE: Local Area Defense (LAD) Demonstration

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CONTRACTING ORGANIZATION: University of Maryland at Baltimore
Baltimore, Maryland 21201

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13. ABSTRACT (Maximum 200 Words)

This pilot program is funded by the Army Medical Department (AMEDD) to demonstrate a real-time detection and rapid response system for local area defense using the University of Maryland Baltimore (UMB) Campus as a testbed. Additional goals includes the identification of Rapid Response teams performance and the coordination of the Campus and Baltimore City Emergency Management Plans and Responses in the event of a environmental sensor trigger. Transmission of images from UMB campus video surveillance cameras and from a mobile wireless platform to North Atlantic Treaty Organization (NATO) Headquarters and University of Regensberg Germany was also achieved. Emergency Operation Center Remote expert review and evaluation of telecommunications were carried out. This demonstration can serve as a model system to test performance of integrated environmental sensors to support Homeland Security threat detection, for protection of a terrorist target that crossed local, City, State and Federal jurisdiction in an urban testbed setting of a major U.S, city.

14. SUBJECT TERMS
Rapid response system, coordinating real-time detection, communication

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Table of Contents

INTRODUCTION

The University of Maryland, Baltimore (UM) Campus is located in Downtown Baltimore City. UM is the home to the a) headquarters of the Maryland Institute for Emergency Medical Services Systems (MIEMSS), which contains the statewide communications (SYSCOM) and Emergency Medical Resource Center (EMRC); b) the R Adams Cowley Shock Trauma Center (STC), internationally recognized center for the Maryland EMS; c) the University of Maryland Medical Center (UMMC), a major tertiary medical center; d) the School of Nursing: e) the Office of the Chief Medical Center (OCME) for Maryland; f) the Charles McC. Mathias, Jr. National Study Center for Trauma and EMS (NSC) at, g) the University of Maryland School of Medicine (SOM); h) the School of Pharmacy and Poison Center; I) the School of Social Work; and j) the School of Law.

Because of these assets, it is a potential terrorist target, while at the same time, rapid coordination of these assets can be a model for other targets. The specific aims of the Local Area Defense (LAD) Demonstration were as follows:

- Demonstrate a real-time detection and rapid response system for local area defense using the University of Maryland, Baltimore (UMB) Campus as a testbed.

- Identify Rapid Response Team and community response capabilities when the environmental sensor system was triggered.

- Assess coordination of UMB Campus and Baltimore City Emergency Management Plans and Responses

- Evaluate the use of images from surveillance cameras and mobile wireless platforms for local (drill control center) and remote (NATO and Germany) command and control decision-making

This pilot program completed successful demonstrations by way of a Table top and Demonstration exercise. The pilot study was coordinated and conducted by the National Study Center for Trauma and Emergency Medical Services.

BODY

A. Statement of Work

1. Identification of key participants in a Local Area Defense (LAD) Demonstration at the University of Maryland, Baltimore (UM) Campus.

A Memorandum of Agreement for participation was signed by President UM Campus, Dean School of Medicine, Executive Director MIEMSS, CEO of University of Maryland Medical Center, Mayor, City of Baltimore, Commissioner Baltimore City Police

Department, USAF Surgeon General, Baltimore City Health Commissioner, Director of the Program in Trauma at the R Adams Cowley Shock Trauma Center, Director Charles McCMathias National Study Center for Trauma and EMS.

2. Integration of the UM Campus Resources (Rapid Response Teams, Expertise, Facilities) and UM Technology (sensors, images and surveillance) with existing Emergency Management Plans of the UM Campus, UM Medical Center, Baltimore City, State of Maryland, Military (Army and Air Force) and Federal agencies in a Table Top Exercise.

UMB Campus is a 70 acre site that contains Local/City/State and Federal jurisdictions and is within a few blocks of the financial, political, marine terminal and tourist center of Baltimore. UM Campus is upstream from the prevailing westerly winds so that terrorist events on UM Campus would impact the Baltimore City population. The LAD Demonstration was therefore a model system to test performance of integrated environmental sensors to support Homeland Security (HS) threat detection, for protection of a terrorist target that crossed Local/City/State and Federal jurisdictions in an urban testbed setting of a major US city. The existing elements of a world class Homeland Security System in Maryland and Baltimore includes:

- UMB Campus with 3 hospitals, 6 professional schools, 4 Rapid Response teams and 20-22,000 people as an Urban Testbed.
- Shock Trauma Injury expertise, VA Hospital caches for disaster and terrorist response and US the Air Force mobile hospitals (SPEARR), decontamination facilities and personnel at Shock Trauma
- Comprehensive State-wide Emergency Medical Services (EMS) network
- Statewide Uniform EMS protocols and ambulance run-sheet data, County Hospital Alerting Tracking System (CHATS) and stand-alone microwave communication system
- Facilities Resource Emergency Database (FRED) linking MD, PA, DE and DC
- National Study Center for Trauma and EMS and Shock Trauma Center expertise in injury and emergency management, UMB, 9 Statewide Emergency Department Network
- UMB and Johns Hopkins University (JHU) infectious disease and vaccine development expertise
- CDC/Department Health and Mental Hygiene (DHMH), Baltimore City, JHU, Capitol Beltway, City and State Bio-surveillance Programs
- Academia, Airport (BWI), Industrial, Military and State (AAIMS) expertise including JHU Applied Physics labs, BWI Security and Fire Department, Northrop Grumman, Applied Science, Ft. Detrick, Maryland National Guard, and NSA experts, SBCCOM and ONR Research Labs.
- Existing MEMA, South Baltimore Industrial Mutual Aid Program, Baltimore City Fire Department (BCFD) and Police (BCPD) Emergency Management Plans and Joint Exercises
- Major military bases at Ft. Detrick and Aberdeen Proving Ground for chemical, biological, radiation and nuclear (CBRN) threat detection and protection.

- Baltimore City capability to support recovery from disasters or terrorist attacks in DC or Maryland military bases.

3. Execution of the LAD Exercise to: a) promote coordination of all participants, b) test technology to promote real-time incident status evaluation, situational awareness, incident management and evolution c) evaluate interagency collaboration and communication.

The LAD Demonstration involved 3 phases and a number of presentations (See attachment 1 & 2).

Phase I was a series of 12 monthly meetings of 2 hours duration held at the National Study Center for Trauma and EMS (NSC). The format consisted of 2-4 presentations on topics of interest to Homeland Security delivered by recognized experts in the field followed by discussion of components or entities that could be included in the LAD Demonstration. (Attachments #1 and #2).. The planning minutes of all meetings are documented and submitted under separate cover and located at TATRC in 2 volumes.

Attendees included representatives from Federal (FDA, NSA, VA Medical Center) agencies, military (US Air Force, WRAMC, ONR, Ft. Detrick (TATRC) MD National Guard, SBCCOM and Ft. Gordon, GA (by teleconference)). State agencies (MIEMSS, OCME, Poison Center, MEME, DHMH, Governor's HS), City agencies (BCFD, BCPD and Health Department, Baltimore City Medical Society), area hospitals (JHU, Univ. Special Hospital, Shock Trauma, VAMHCS), Industry (Northrop Grumman, Applied Science, DynCorp, Optimetrics Inc., CDI Media Systems), Campus Schools/Division, President's Office, Dean's Office, Facility Management, Environmental Health & Safety, Police, Media, IT, Engineering, Medicine, Nursing, Law, Social Work, and Pharmacy. (Attachment # 3)

Phase 2

A series of small group meetings then developed a timeline for the LAD Demonstration, producing a scenario and provided specific and detailed event sequence and evaluation documents and identified appropriate injects for a Table Top Exercise (Attachment #4). Following the Table Top Exercise another series of small group meetings developed a similar document for a Demonstration Exercise involving all the UM Campus, agencies, MIEMSS, OCME, Poison Center, VAMHCS, Shock Trauma Center, UM Medical Center, Baltimore City Fire, Police and Health Departments, MEMA, FBI, Ft. Gordon, NATO Headquarters, Brussels Belgium, University of Regensberg, Germany (Attachment # 5).

The evaluation forms to be used by the NATO Headquarters and University of Regensberg during real-time video surveillance camera and mobile wireless image review of the Demonstration Exercise were developed by the PI.

Phase 3

The final phase included the conduct and evaluation of a Table Top Exercise on February 27, 2004, and a Demonstration Exercise on March 26, 2004.

4. Provide a final report of Table Top and LAD Demonstration Exercise, which identifies the generalizability of the findings to other local area communities with a need to develop their terrorist detection and response plans.

Results of Table Top Exercise

Scenario

One week ago *a transport courier was assaulted while delivering Iridium 192 to Radiation Oncology.* ***Today*** *a campus radiation sensor is triggered and a phone call is received that a car loaded with explosives is parked on Campus.*

Over 100 Participants and Observers were involved in the Table Top Exercise including representatives of 7 Federal Agencies, 7 State Agencies, 7 Baltimore Hospitals, 3 City Agencies, 5 UM Schools, 9 Campus Divisions and 5 Departments, JH School of Public Health, DynCorp. and CDI Med Systems.

The events of the Table Top Exercise were audio-video recorded. Each of 5 Table Leaders summarized their group responses to the Table Top Scenario. Real-time notes were typed and projected to ensure a consensus from Campus, Hospital, City, State and External Review Tables. These summary consensus points are attached (Attachment # 6). The audio-video recordings were reviewed by Dr. Mackenzie and Summary Recommendations were made from the Table Top Exercise. The recommendations were circulated and suggestions for revision made by attendees at the next 2 LAD meetings were incorporated. The final version of the LAD Table Top Exercise recommendations are as follows:

1. Simplify Campus Emergency Management (EM) Response Plan – Operational Portion
2. Consolidate Campus Emergency Operation Centers (EOC's) to facilitate communication
3. Conduct Communication Exercise
    a. Campus Internal
    b. Off-Campus
4. Review & Analysis of UM Campus EM Response Plan with UMMC, VAMHCS, BCFD, etc.
5. More Inclusive of VAMHCS resources and VA Emergency caches.
6. Make EM Response Plans of Campus and Hospitals more accessible and coordinated.
7. Clarify the evacuation/shelter-in-place policy and procedures.
8. Allow 2nd in command to be in charge for Exercises.
9. In real emergency make optimum use of MEMA personnel to assist hazard mitigation and evacuation.

10. Documentation of UM Campus Exercise as model system.

Evaluations (n=55) showed scores of >4 (on scale 5= best) for realistic exercise scenario that helped preparedness; revealed importance of coordination with outside agencies; identified awareness of how events change rapidly; showed need for media and single spokesperson strategy.

Results of Demonstration of Exercise

Scenario

The Demonstration Exercise started at 9:45 a.m. when a "Dirty Bomber" gained access and planted a clean bomb in the MIEMSS building alongside the Emergency Medical Services Systems Communications (SYSCOM) room. At 10:00 a.m. the same bomber planted a second "dirty bomb" at the University of Maryland Medical Center (UMMC) loading dock. This dirty bomb consisted of a real gamma emitting radiation source that triggered the campus radiation sensors. The auto-dial message that the sensor sent to the Campus Environmental Health and Safety (EHS) Agency prompted them to send a technician to the site of sensor alarm. Subsequently the Campus Police were alerted and the Baltimore City Fired Department and Police Department became involved. Campus, UMMC, VAMHCS and City Emergency Operations Centers were established. Incident Command escalated from EHS, to Campus Police to BCFD, and subsequently involved the BCPD, FBI and the Bomb squad. The complete scenario and event injects are described in detail in attachment #7. Sixteen evaluators were (in 8 pairs) stationed at key positions around the Campus to perform evaluations. In each pair of evaluators, one was external to UMB, the other was familiar with UMB Emergency Management Plan Policies and Procedures. The evaluation book completed during the LAD Demonstration Exercise is shown in Attachment #7.

Parallel to this activity a second evaluation process was carried out in NATO Headquarters in Brussels by the NATO Disaster Coordinator and 2 additional experts. A second remote site was at University of Regensberg, Germany where there were about 20 experts from Germany, Police Fire, Medical and Disaster Management agencies. There was in addition participation by representatives of the US Army. The remote command and control locations reviewed real-time UMB Campus video surveillance camera images (in black and white), and color images from a mobile wireless video transmitter that followed the action of the two bomb scenarios. The evaluations were conducted at two remote sites. The remote evaluation data forms and results are in Attachment #8. The ISDN line bridge to NATO Headquarters and University of Regensberg was supported by our collaboration with Ft. Gordon, GA, Center for Total Access.

Twenty recommendations resulted from the LAD Demonstrations and were distributed for comments and revised to incorporate suggestions (Attachment #9). The final version of the recommendations from the LAD Demonstration are as follows:

1. Voice radiation sensor alarm message should be repeated more than once and be more comprehensible.
2. Educate first-on-scene that Emergency Management Plan states that they are the incident commander (IC) until relieved when they pass on information of event directly to next IC.
3. Test and re-evaluate the Robot remote radiation sensor detection when in analyze/peak function mode to correct cause of failure in LAD Demonstration.
4. Improve coordination of walking worried (WW) meeting points with Campus counselors (CC). CC needs identifiers and better communications with IC and to have more staff.
5. Re-programmed radios should be checked systematically. All emergency radios should be operational. Call back check from key players (i.e. UMMC/Campus) by pre-determined protocol.
6. Audio transmission via an IC radio to all controllers would greatly augment mobile and fixed images. Have IC communication to drill controllers as a routine safety check to confirm "injects" carried out
7. IC should be removed further away from bomb location (limitation of drill site, in reality would have been further away).
8. Send VAMHC policy on how to respond to phoned in bomb threats to TV stations as they have no policies in place.
9. EOC for Campus in a place where cell phones can send and receive signals and pagers, email and wireless technology radios work – requires signal booster technologies for EOC to avoid communication dead spots.
10. Group email should be modified to allow accommodation of different emergency plan status in different buildings. A spread sheet identifying response required on a given campus building would standardize information transfer and avoid confusion of suggestions shelter-in-place when earlier evacuation had occurred.
11. More frequent campus Exercises to ensure new personnel are trained and ensure continuity with personnel turnover.
12. UM Campus Police should familiarize themselves with MIEMSS Emergency Management and IC System.
13. Floor wardens should take documentation to assembly point and stay to interface with UM Campus Police & BCFD/BCPD.
14. BCFD should convey information to Bomb Squad about bomb location in a building.
15. Floor plan of building should be provided to incoming Emergency Responders.
16. There should be remote EMRC back-up in other part of State than UM Campus. Alternate use of hospital "red phones".
17. No simple solution to account for who is in a building at time of threat detection. Card swipe/ID sensors on entry and exit would provide needed data.
18. Communications Exercise are required to avoid communication failure between UMMC and UM Campus.
19. "Layered" information delivery with redundancy to ensure dissemination and avoid the situation where UMMC Security staff was unaware of LAD Demo and Bomb Threat.

20. Alternative site to Pearl Street Garage for EOC or signal boosters to remove dead spots.

Evaluations

Pairs of evaluators for LAD Demo were positioned in Command and Control (EOC), Communications Dirty Bomb location, Clean Bomb location, Incident Command, Press, Drill control center. Details of each location evaluations are attached. A summary evaluation form was also completed (all included in Attachment #7). Transfer of authority at IC received a score 3.5 (5=best), communication score=3.6, scenario tested personnel and equipment=4.5, personnel responded in timely manner=4.2.

KEY RESEARCH ACCOMPLISHMENT

There were many accomplishments during this period of execution of the LAD Demonstration and documented throughout the report and support with attachments and publications.
Two presentations were made at the American Telemedicine Association 9th Annual meeting and exposition held in Tampa, Florida in May of 2004. The presentations included the following:

a. **Title**: *The added value of still images of different sizes as an adjunct to wireless mobile video of Homeland Security Exercise (HSE)*

   Hypothesis: High quality still images convey details and situational awareness not recognized in low bandwidth video.

   Methods: Images were transmitted to Emergency Operation Centers (EOC) to Germany, Belgium and the University of Maryland Baltimore (UM), Personnel (n=16) were provided high quality thumb-nail still images of HSE after they had viewed the video (1 frame/sec(fps)=slow, 20 fps=fast) and made remote assessments of HSE events. EOC's scored (1=strongly disagree, 5=strongly agree) the usefulness of video and still images of HSE.

   Results: Slow mobile video usefulness for: disasters 4.7, incident commander 3.8, trauma extrication 4.3, slow color video was better than fast fixed black and white (B/W) video 4.2, still images identified information missed on video 4.7, clarity of still images increased understanding of events 4.4, the combination video and still images was best 4.8, thumb-nail images size OK 4.8, larger images needed 1.4.

   Conclusion: Intermittent high quality still images can augment understanding and information extraction from slow, low bandwidth color and fast B/W video by remote EOC.

b. **Title**: *Situational Awareness by Video Surveillance for Homeland Security*

Hypothesis: Remote experts can identify real-time emergency events through mobile color and fixed B/W surveillance images of a HSE, simulating Dirty and Conventional bombs.

Methods: Remote experts situated at University Regensberg, Germany (UR n=9) and NATO HQ Brussels (n=3) were connected (ISDN) through Fort Gordon, GA from the University of Maryland where HSE occurred. Background questions were answered by the on-site expert. Evaluations were completed serially during HSE

Results: Transmission gaps occurred due to service providers interoperability problems that interrupted images transmission to NATO for 1.5h, but UR and NATO identified *on-site decisions* including: bomb location, building evacuation, bomb squad defusing, *emergency team activities:* evacuation, shielding, readiness for casualties. ***Specific Issues Recognized:*** potential for international links for command/control (C2), insider knowledge commentary and local maps essential to remote understanding, language barriers, B/W images inadequate, fixed cameras sensitive to sun. ***Suggestions***: Duplex audio with field mobile camera at C2, remote control of fixed camera, helicopter overview image would be helpful, infra-red camera for night use.

Conclusions: Technical difficulties and unreliability of image transmission occur in real-time use, despite pre HSE testing. Color images and local commentary help. Remote monitoring with video can identify safe entry and activities of EMS personnel.

REPORTABLE OUTCOMES

The LAD demonstration showed collaboration between federal, state, city and local agencies in response to a realistic terrorist threat. It assessed UM Campus other abilities in communication environmental sensor use, abilities to control access and the walking worried. It showed how BCFD coped with 2 nearly simultaneous events and improved the UM Campus and Baltimore City rapid response and coordination of emergency management plans. The images from campus surveillance cameras and mobile wireless video platforms were very successful in maintaining situational awareness of local and remote decision-makers in command and control, incident command and the drill control center.

CONCLUSION

The following publications represent the conclusions drawn from this extensive planning and execution of both the Table Top and Demonstration Exercises as a result of this funding:

Title: Recommendations and Findings from Local Area Defense (LAD) Homeland Security Exercises (HSE)
Authors: Colin F. Mackenzie, MB, ChB, FRCA, et.al
Affiliations: National Study Center for Trauma and EMS, University of Maryland (UM), UM Medical Center, Shock Trauma Center, JHU, MIEMSS, MEMA, VAMHCS, OCME, DHMH, BCFD, BCHD, Dyncorp, inc, CTA, TATRC

Title: Nuclear Terrorism: Low-Yield Nuclear Explosions and acute Medical Implications
Authors: Colin F. Mackenzie MB, ChB, FRCA and David Hartley, PhD, MS
Affiliations:: Departments of Epidemiology and Preventive Medicine, Anesthesiology, University of Maryland School of Medicine and the Charles McCMathias, Jr., National Study Center for Trauma and EMS

Title: Extending Injury Prevention Methodology to Chemical Terrorism Preparedness: The Haddon Matrix and Sarin
Authors: Shawn Varney, Lt Col, USAF, MC, et .al
Affiliations: The Charles McCMathias, Jr., National Study Center for Trauma and EMS

Title: Evaluation of Slow Mobile Color Video, Fast Fixed Black and White Video, and High Fidelity Still Camera Images for Remote, Real-time, Homeland Security Event Monitoring.
Authors: Colin F. Mackenzie, MB, ChB, FRCA, et.al
Affiliations: Charles McCMathias, Jr., National Study Center for Trauma and EMS Department of Anesthesiology University of Maryland, NATO, Civil Emergency Planning, Department of Surgery University of regensburg, Usmy Centers for Total Access, Fort Gordon, GA and the Telemedicine and Advanced Technology Research Center

Acknowledgement

This study was funded by US Army MRMC Grant # DAMD 17-03-01-0159 through the Telemedicine and Advanced Technology Research Center (TATRC).

This work would not have been possible without the extraordinary helpful participation of the many attendees and presenters at LAD events (See Attachment #10 for participants) and for the administration support of Ginny Goble and Diane Harris, at the National Study Center for Trauma and EMS.

Attachments

- #1 Planning for Local Area Defense Demonstration, Vol. 1, Oct. 2002-Jan. 2003
- #2 Planning for Local Area Defense Demonstration, Vol. 2, Feb. 2003-Apr 2004
- #3 MOA for participation in LAD
- #4 LAD Table Top Exercise, (Feb. 27, 2004) Evaluation and Injects

#5 LAD Demonstration Exercise (Mar. 26, 2004) Evaluation and Injects
#6 LAD Demonstration Controller Team Injects (6A) and Facilitator (6B)
#7 10 Recommendations from LAD Tabletop Exercise
#8 LAD Demonstration Evaluation Book
#9 Connections made for Remote Emergency Operation Center
#10 Remote Evaluation (NATO & Univ. Regensberg, Germany)
#11 Recommendations from LAD Demonstration Exercise
#12 LAD planning, Table Top and Demonstration Exercise participants
#13 Overall LAD Plan Rationale

Acronyms

BWI	Baltimore-Washington International (Airport)
CDC	Center for Disease Control
CEO	Chief Executive Officer
DC	District Columbia
FBI	Federal Bureau Investigator
FDA	Food Drug Administration
EMRC	Emergency Medical Resources Center
HS	Homeland Security
IT	Information Technology
JHU	Johns Hopkins University
MEMA	Maryland Emergency Management Agency
MIEMSS	Maryland Institute for Emergency Medical Services Systems
NATO	North Atlantic Treaty Organization
NSA	National Security Agency
ONR	Office of Naval Research
SBCCOM	Soldier and Biological Chemical Command
SPEARR	Small Portable Expeditionary Air Rapid Response
TATRC	Telemedicine and Advanced Technology Research Center
VAMHCS	Veterans Administration Maryland Health Care System
UMMC	University of Maryland Medical Center

ATTACHMENT #1 - Planning for Local Area Defense Demonstration, Vol. 1, Oct. 2002-Jan. 2003

Planning for a Local Area Defense Demonstration

Volume 1

October 2002 – January 2003

Speaker	Topic	Date
Richard Alcorta	MIEMSS	October 2002
	MIEMSS – FRED	November 2002
Bruce Anderson	Maryland Poison Center	January 2003
George Anderson	Navy Research Laboratory Sensors	December 2002
William Beninati	USAF	November 2002
Jim Campbell	Vaccine Development	October 2002
	NIH Center of Excellence	November 2002
Nkossi Dambita	Baltimore City	October 2002
Howard Dickler	UM School of Medicine	October 2002
John Donohue	MIEMSS/FRED	January 2003
Michael Greenberger	Center for Health & Homeland Security	October 2002
LTC James Grove	MD National Guard	November 2002
Mary Leach	President Ramsay's Office	October 2002
Don Lumpkins	MEMA	January 2003
Colin Mackenzie	National Study Center	October 2002
	Biodefense Initiative	November 2002
	Rapid Response Teams	December 2002
	LAD Funding Status	January 2003
William Morgan	Dirty Bombs	January 2003
Pat Redmiles	DynCorp-DTRA Biodefense Initiative Albuquerque Sensors	December 2002
Jeff Roche	DHMH	October 2003
LTC George Steiger	SBCCOM-Aberdeen	November 2002
Pat Tate	Emergency Management Plan, UMB	December 2002
Ruth Vogel	Terrorism Preparedness & Response Baltimore City	December 2002
Yan Xiao	Telecommunication	November 2002

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Meeting Agendas
Minutes & Slides

Meeting Agendas
Minutes & Slides

January 14, 2003

January 14, 2003

Goble, Virginia (Ginny)

From: COLIN MACKENZIE, MD [cmack003@umaryland.edu]
Sent: Tuesday, January 07, 2003 2:11 PM
To: yxiao; Dischinger, Pat; Jon Mark Hirshon, MD, MPH; oglivie; ron.poropatich; Johnson, Cheryl; Goble, Ginny; Hdickler@som.umaryland.edu; J. Glenn Morris, Jr.; hstandiford@umm.edu; Edward Cornwell; Mary Leach; william.beninati@pentagon.af.mil; Greenberger, Michael; John Krick; David Blythe; Julie Casani; Jeffrey Roche; 'mdonnenb@umaryland.edu'; clyburn; pbeilenson; jspearman@umm.edu; Stringer, Jeanne; mlevine; nkossi.dambita; ruth.vogel; jcampbel; parker; tganous; ralcorta; Steiger, George E LTC SBCCOM; rrothman@jhmi.edu; dburke@jhsph.edu; dtaylor@jhsph.edu; gkelen; jdonohue; Whitby, Linda Dr FBA; Grove, James W. LTC; jflynn; gzimmer1; banderso; jarose; smvarney; rthompso; tshirtman45; dschrader; jerry.stockton; pat.redmiles; dfloccare; rbass; ptate; wfmorgan; pkbuckm; dwhyne; ganderson; cthorne
Subject: Meeting Tues Jan 14th 2003 at NSC

You are invited to a planning meeting for Local Area Terrorist Defense Demonstration

Time : 10 -12 Noon
Date : Tues Jan 14th
Place : National Study Center for Trauma & EMS (NSC)

AGENDA

1) Introductions of Representatives from City , State , MIEMSS, Military & University of Maryland

2) Dirty Bombs -- Detection & Response
William Morgan PhD, Professor of Radiation Oncology

3) Maryland Poison Center -- Role in Chemical Attack
Bruce Anderson Pharm D --- Director

4) MEMA (invited) Integration & Coordination of Local & State Response

5) Demonstration funding status & Plans
Colin Mackenzie M.D.---- Director NSC

Pastries will be served

Parking available in Penn St Garage (entrance on Penn St & on left in Ist Block of Pratt St coming off MLK Blvd) Please bring ticket for validation

We hope that you can make the meeting . Happy New Year

Local Area Biodefense/Surveillance Meeting Notes

January 14, 2003
10 a.m. – 12 noon

National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

Maryland Department of Health & Mental Hygiene
Julie Casani, MD, MPH Director, Anti-terrorism Program (jcasani@dhmh.state.md.us)
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USAMRMC, TATRC
LTC Mary Parker, MD (parker@tatrc.org)
Claudia Oglivie, Program Director (oglivie@tatrc.org)
United States Air Force
Major Shawn Varney, MD, Chief, Homeland Security and Disaster Preparedness (C-STARS) (smvarney@aol.com)

The meeting began by the participants introducing themselves (see cover page). Dr. Mackenzie welcomed all present and identified the objectives of the meeting as 1) Presentations by Bill Morgan on Dirty Bombs, Bruce Anderson on the Role of the Maryland Poison Center on Chemical Attack, Don Lumpkins on MEMA's role and Colin Mackenzie on funding status; 2) To discuss Rapid Local Area Detection and Response to Chemical/Radiation bomb attack and real time update capability 3) coordination and integration of local area resources at site of attack with city/state/federal responders 4) UM, B campus special issues; evacuation, access, psychological casualty management , education.

Dirty Bombs, Bill Morgan PhD, Professor Radiation Oncology discussed dirty bombs (see his slides as attachment #1). We are exposed to radiation every day from several sources including the environment, during air travel, building material, food, medical diagnostic and therapeutic radiation (220 million procedures/year in U.S.).

Dirty bombs and radioactive terrorism can be considered in 2 ways 1) Nuclear bomb of mass destruction; 2) Radioactive 'bomb' -no explosion – but good terrorist weapons. Radioactive sources could be scattered around the community and be as equally effective as a terrorist event. Hiroshima: 100,000 killed outright. Increase in cancer 421 people over expected (21,643 of 86, 572 survivors) Chernobyl: This was a protracted contamination NOT an acute event. 200,000 people getting significant chronic irradiation.

Immediate Problem 1) Diagnosis of radioactivity 2) What Isotopes 3) How extensive is contamination e.g. rivers and soil 4) Who is going to access the site and where are radioactive survivors going to go.

Dosimeters can tell radioactivity – but we need to know dose rate. Time, distance and shielding can make a significant difference to radiation exposure. Need to know type of radioactivity (isotopes). Alpha particles can be stopped with paper, Beta ray has minimal penetration – stopped by skin, gamma rays are highly penetrating and require lead shielding or concrete. We need to know the duration of exposure – This may be very difficult with dirty bomb. Have to decide who gets personal dosimeters maintenance, training and calibration of dosimeters. Where will dosimeters be placed in cities? Do they feed back to central command and have alarms?

EMS people are going to get survivors – we want to avoid finding that the area is contaminated 2-3 days later. We need to know where the radioactivity might go and the isotope. Lifetime of isotope varies, Cesium and Cobalt are the most likely agents (with ½ life 30 years) as these are quite easy to obtain. After the event the critical thing to try and find out is what dose the survivors got.

The perception after Nagasaki is that those exposed are damaged. Potassium Iodide is only going to protect against thyroid irradiation. Triage and counseling is required.

Dose determines survival <2g rays no treatment, 2-7 g rays treatment with antibiotics and nursing can survive L D50 at 7 g rays. 8-10 g rays, fatal whatever one does, in 36-48 hours.

Cherynobyl ¼ million pregnancies terminated – the fetus is very vulnerable 9 days post conception – 41 days – 100% of fetuses are abnormal. After that there may be mental retardation if exposure is significant. The long-term issue is of "survivor perception" and repopulation – is it adequately cleaned up? A massive amount of money is being spent to clear up the after effects – sifting through debris to find radioactivity. The recovery phase is a major problem.

Q: How do we prepare for and respond to a dirty bomb?

A: There is a lot of misconception about radioactivity. No people died at 3-mile island. People tend to believe medical radiation is 'good" radiation and nuclear power plant is bad.

Q: Radiation can be emitted without any bomb going off. What is the likelihood that terrorists would plant radioactivity in several places in, say, a building, with an insidious onset of vague symptoms among people who were daily in the building? Most people would be difficult to diagnose.

A: The thinking is that the terrorist actually wants you to know the radioactivity is out there – so they attach it to a bomb - but for effectiveness the covert planting of radioactivity is real. If the terrorists did put a few seeds of Cesium around a city, it would be a major undertaking to find it.

Q: How would you set the sensitivity triggers/alarms of radiation sensors in a hospital where people are coming in and out with radioactivity?

A: This is a major dilemma. Clean up by DOE in some sites at costs of $Billions is actually making the ambient radioactivity in these sites less than say normal background radiation in Denver, Colorado. How sensitive do you want to detect? Do you want to detect individual patients with high cardiac isotope exposure on the UM,B Campus or do you want to trigger for the scenario in the earlier question for a low chronic emission? The sensitivity can be set at whatever you like.

Q: You talked about radio iodine in the context of concentrating in the thyroid – are alpha and beta radiation taken up into the lung? Is that a greater hazard? Harder to detect?

A: It is very hard to detect. Any internal isotope is difficult, e.g., radon is inhaled and goes into the lungs – if you are a smoker, it compounds the problem. However, we can detect incredibly low levels of radiation 360krem/year is the Baltimore exposure – we can detect 1 krem no problem.

Maryland Poison Center – Bruce Anderson – Director
800-222-1222 is the universal telephone number for poison centers across the country – you will automatically be routed to the center that serves the area from which you are calling.

Maryland Poison Center has been in the School of Pharmacy for the past 30 years, 60,000 calls per year, 35,000 involve people getting exposed – the other 25,000 are animal exposures as well as calls for information with no exposure. Open 24/7. Staffed by pharmacists, nurses with additional toxicology training – not volunteers – full-time resource with average experience of 7-

8 years. Each person answers 3500-5500 calls/year. In addition, Medical Director is boarded in Emergency Medicine as well as toxicology and board certified Clinical Toxicologist and Epidemiologist on staff. We collect and provide information and report our experience to a national central database. Data updated every 30 minutes nationally. Part of this database has been modified as a surveillance tool. Central database may detect a trend. Please help when Poison Center calls for follow up on patients. Research includes data on how to manage certain poisoning.

Mission: To decrease the cost or complexity of care while maintaining and or improving outcomes – i.e., save lives – save $$.

Role in chemical attack. Primary role is the same – to provide information and be a resource. If we can get information out to those that are dealing with patients that should improve outcome. How do we get the information out? When we get information on triage, symptoms, etc., we can make recommendations for treatment tailored for adults and children. Often not a lot of general knowledge about what the antidotes are – particularly in patients with medical problems, e.g., renal failure or pregnancy.

We coordinate antidotes between and among institutions – save $ by sharing infrequently used antidotes. We provide information to general public – during the Baltimore Tunnel Fire – 500 calls/questions about sickness. We work with DHMH and EMS and serve as data collection source for follow up and public health information.

Scenario – hundreds of victims in ED at UM,B – symptoms inconsistent with pure blast – poison center contacted by EMRC as well as UMMC. Poison Center job is to make best educated guess about what is going on – until definitive identification of toxin is made - look at toxidrome – send information to ED staff at DHMH and Pharmacy to get antidotes. We can bring in additional staff, but we are limited as we only have 10 FTE's for 24/7 coverage. Provide information to media and document exposure.

Facility Emergency Resource Database (FRED) – Will be used for assistance with alert – resources. Dosing information for adults and children can be put out through FRED.

Q: Are you trained to treat Biologic Toxins? Chemical Toxins? Chemical Attack? Do you have a toxidrome for Botulism Toxin? Anthrax? Smallpox?

A: Bleach is one of the most common chemical poisonings. Botulism exceptionally rare – I can't tell you that everyone would be able to speak to this. However, we are involved in training – of community health professional – funding for bioterrorism training has improved this – getting people up to speed on the biologic problems. Anthrax, tularemia, viral/hemorrhagic fever – also get information on how to deal with National Pharmaceutical Stockpile. Getting better, but not there yet.

Q: Is Botulism a biologic agent or chemical toxin?

A: It doesn't matter – the reaction is same – have to recognize it – depends on quality of reporting.

Q: How do we speak with one voice to the media?

A: Difficult. The demonstration at UM,B may help get everyone communicating to establish channels to use in these circumstances.

Q: Do you get snakebite calls?

A: Yes. If you ask the question – have you ever been contacted about ……., the answer is always yes!

Q: How do you prioritize calls in a terrorist event? You have only 10 FTE's.

A: We will not even get many of these calls – they will hang up – they will call 911 – go to ED. We are deploying additional resources in the telephone system to set up automated voice responses to deal with large volumes of calls. In tunnel fire episode, we did not require additional resources, as most of calls were the "worried well." Job is primarily about triage – is this about a dog, or wanting Mr. Yuk stickers or a real case! Information dissemination through FRED – local Fire Rescue Emergency Response can be coordinated in the short term through FRED. MEMA is also a source through their joint information centers.

Q: Has anything been developed to have a standard recorded message to poison center calls? One phone call can trigger a chain reaction for disseminating information: Website?

A: We are working on standard responses. School of Pharmacy website, www.pharmacy.edu - click on centers and poison center page will pop up. New site, www.mdpoison.com will be up in next 3-6 months.

MEMA – Don Lumpkins, Director
Office of Domestic Preparedness Administration – an office inside MEMA – to coordinate state and local efforts as related to terrorism. Article 16A, Annotated Code of Maryland, MEMA's responsibility is to coordinate and manage state response. It also creates the local management agencies to do this at the local level (tape changed) – wrong side put in – no audio for the remainder of Don Lumpkins' presentation or for Colin Mackenzie's presentation. The error was noted and corrected with Dr. Julie Casani asking a question after Dr. Mackenzie's presentation. The following summary of this talk was prepared by Colin Mackenzie (not from audio record).

Colin Mackenzie, MD Director NSC -- Funding Status and Plans of Demonstration Project. The pre-proposal was submitted to Ft. Detrick in December 2002. On Friday 10th January 2003, I received a request for a full proposal. Should funding be obtained there will be a short turn around. Possible time frame for start of funding April 2003, making a demonstration possible in early 2004 (see Dr. Mackenzie slides as attachment #3)

The problem in responding to a local area terrorist attack at a potential target is that the Rapid Response Teams with expertise in Chemical/Radiation hazards take too long to deploy. Deaths of potentially salvageable victims start to occur within minutes from VX or Sarin. Real-time detection and monitoring of local areas for Chemical/Radiation attack is currently inadequate, and there are no civilian demonstration models of coordinating expertise and resources in a specific local area. The Demonstration project at UM campus would include real-time detection and response as well as identifying some measurable performance of the response, i.e., can we get 100 mechanical ventilators, personnel to manage hospitalized casualties etc. We would also develop strategies for mass psychologically as well as physically injured victims. In past terrorist attacks involving US citizens, more than 70% of which have been bomb attacks, there has been a 60-80% over triage rate. The attack on Marines in Beirut had a 70% over triage rate.

The local community at UM campus involves the Medical Center, Shock Trauma, Air Force, School of Medicine, Poison Center, MIEMSS and Baltimore City. The demonstration would involve collaboration with Federal, State, city, campus, School of Medicine, Hospital and MIEMSS. The campus itself has MIEMSS' headquarters, National Study Center, OCME, University of Maryland, Medical Center, Shock Trauma Center, Vaccine Research Center, Maryland Poison Center, VAMC as well as School of Medicine, and Schools of Nursing, Law, Social Work.

The plan is to make existing city daily surveillance into real-time detection by deployment of chemical/radiation biosensors on UM campus. When these sensors triggered, one of five rapid response teams on UM campus would respond taking with them a mobile imaging system that allows command and control to see what is happening. In addition, access to the campus video networks would be made available for on-site incident command and remote command and control. With update of the event as it evolved, Baltimore city command and control would be able to determine what resources were required (see figure one in slides). The demonstration would, therefore, involve sensors, mobile imaging with a video network having deployment of a Rapid Response Team, and communication with Baltimore City command and control. The scenario would include two events in close proximity, such as a bomb explosion and chemical release.

The demonstration would be the product of planning that coordinates the UM campus response. We would evaluate ideas for psychological casualty triage and well as test the MIEMSS electronic triage tag. The demonstration would also evaluate the data provided by environmental sensors.

The military relevance (since this may be a model for military bases and civilian targets of attack) is that we will demonstrate collaboration between different agencies in rapid detection, response and casualty triage, treatment and control. We will also assess some performance criteria for the Rapid Response Team.

Q: How would you plan to evaluate data from these sensors?

A: One way would be to have portable devices used by First Responders that can give a rapid early "read". This would be followed up by confirmation from experts. We are considering

working with SBCCOM to establish access to their expertise. The idea is that we should be able to do something to make use of the on-campus resources in the first 15-60 minutes when outside resources might not be able to get here. We have to save our own souls as it were.

Comment (Don Lumpkin, MEMA): MEMA would not do anything in the first 15 minutes. More confirmation is needed.

(Audio tape begins again with this question from Dr. Casani.) Q: With a local attack on the UM campus, initial contact would be with the city agency; they would escalate it to the state agency and then to Federal agency. Are you looking at it as a uniquely vulnerable site or a potential response source?

A: I am looking at it as a model that would be applicable in other situations where there are resources (not necessarily the same as UM, B) that are unique, so that the immediate response can capitalize on these resources while integrating these efforts with the city and state level. The effort will transition the care over to the rescue team that first arrives at the UM campus in the smoothest possible way. One of the objectives would be to ensure that situational awareness is rapidly transferred to the incoming rescuers – What resources there are so that everyone gets "up to speed" as rapidly as possible to coordinate these activities. How do we make access to say the video campus network available to the incoming team? The demonstration will include planning on how we rapidly open these channels to the incoming team in emergency situations. So this might be a model for a military base, the state office buildings. It's all the same principle to maximize what we have in that local area when an event occurs.

Comment: (Dr. Casani DHMH) We have a lot of locations or sites that do have many agencies – State, Federal, local governments -- so there is tremendous translation to other places .

Comment (Dr. Greenberger, Center for Health and Homeland Security): What is the university going to do if we should be attacked? We have to do whatever we can, not to replace the public response but to get ready for it.

Comment: (Dr. Hirshon, National Study Center) How do we develop the model to make it work? The answer to the earlier question is really yes to both – we are a vulnerable site and we do have resources.

Comment: (John Donohue Region III EMS coordinator) The other aspects of education that are key include the EMS. Whatever is planned on the UM B campus has to be contingent on what goes on everyday. When people are stressed on they go back to doing what they are used to doing. One of the most difficult problems with mass casualty triage is that the EMS deals with individual patients. They have to deal with people quicker, rather than deal with them in a different fashion. The project sounds as though it has a lot to do with surveillance and we need to emphasize contact with the city – you already have the Health Department involved – Emergency Management and Fire will also need to be contacted. They are the people who will know that something is going on and they will just be there because some are happened call 911. What we need is to promote situational awareness for these guys. When they come, is there a place where they can easily plug in to get information, e.g., fire enunciators? Fire alarms go off

frequently and the fire department can go to the enunciator panel; they are standard – to provide information straight away – it could be a computer programs that they are used to dealing with all the time that would give them information. The effort should continue on surveillance and detection. The command and control needs to be exercised – the model will be how do the UM,B campus agencies interface with those of the responders coming in. The campus police are going to be overwhelmed and they are useful in responding. We need to help ourselves as a vulnerable site at the same time we need to make use of what we have.

Q: An example is the School of Social Work. How do we deal with the psychological casualty?

A. (Dr. Burmaster School of Social work and Campus Health Science) The campus has been working for a year or so to determine how social work would respond when we did the drill in July. We were involved in more than ½ of the victims. It was necessary for us to be involved because of the psychological nature of terrorism. Managing crowds and conveying the messages that had were going out to the victims and others involved. We labeled ourselves as the Information Center, rather than Counseling Center. Information was most dominant need. MSW skills including our knowledge of human behavior and communication of information to mitigate the problems were particularly useful.

Comments (Dr. Mackenzie): Another unique resource on this campus is the presence of the Air Force at Shock Trauma and their decontamination facility.

Comments (Major Shawn Varney, USAF): The Air Force does have a decontamination capability that can manage a large number of people. The decontamination unit is stored in a very accessible area outside the Ambulance entrance to the Shock Trauma Center and New Emergency Room. We are working on getting people from the University trained so that there will be a core of people who can work together with Baltimore city Fire Department to respond.

The Air Force also has a lot of personnel who specialize in chemical weapons response training, and can explain the symptoms and toxidrome, as well as bio-weapons and biological threat assessment. Some of the Air Force educational courses are summarized in attachment #4.

Comment (John Donohue, EMS Region III): Since they are not Hazmat trained, the way local resources get called to the scene is by the First Responders who are called in. MEMA does not get involved unless there are more than two to three state agencies involved. The way MIEMSS gets involved is the local First Responder calls us in – EMRC gets notified of a mass casualty. UM, B needs to plug into these resources. This is part of the process of 1)detecting the contamination; 2) assessing the contamination before a response – We need to have the cavalry ready to roll. Example : The Amtrak crash back in the '80's – had to keep hospital on standby. Disaster response needs to be measured with current information. Have people on standby but not necessarily in the hospital until the evaluation of need is complete – a scaled response.

(Dr. Mackenzie) Final comment: The UM, B plan will, of course, be integrated with existing disaster plans such as those of the UM hospital and the campus, Facilities Resources and city plans. We will let you know about funding and will wait until we get some more specific information before scheduling the next meeting. Thank you all.

Attachment # 1

Dirty Bombs
Detection & Responses

William F. Morgan, Ph.D.

Radiation Oncology Research Laboratory
Department of Radiation Oncology
University of Maryland, Baltimore

WFMorgan@som.umaryland.edu

Mans Radiation Burden (360mRem/year)

Air travel
Testing fallout
TV & luminous watches
Nuclear power plants (20%)
Radioactive waste
Diagnostic & therapeutic radiation*

Cosmic rays
Air (radon)
Building material
Water
Food
Earth

*Diagnostic radiology > 200 million procedures/year

Considering "radioactive" terrorism

Nuclear event (bomb or attack on a nuclear installation)
- mass destruction

Dirty bomb
- will not enhance effectiveness of bomb
- effective terrorism

Do not need explosion

Exposure Scenario

Acute (explosion)

Hiroshima, 1945

Killed outright	100,000
Survivors studied	86,572
Expected cancers (no bomb)	21,643
Observed cancers	22,064
Increase	421

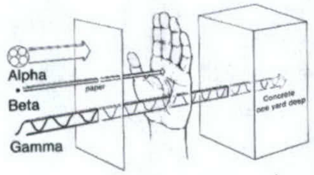
Exposure Scenario

Protracted (contamination)

Immediate issues:

Is it radioactive? Isotopes?
Extent of contamination? Accessibility?

Dosimeters available
•radioactive
•isotope



Issues:
•Who get dosimeters
•Placement in cities
•Maintenance and operation

An event involving radiation occurs

Contamination

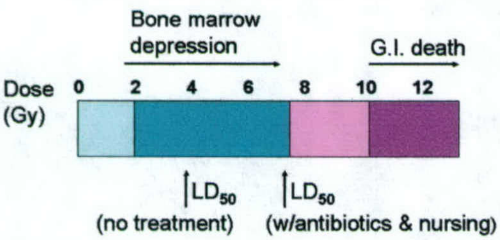
Emergency personnel
initial + second hand exposure
Wind, water & food chain distribution
Lifetime of isotope

$Uranium^{238}$	4.5×10^9 years
$Plutonium^{239}$	2.4×10^4 years
$Cesium^{137}$	30.17 years
$Iodine^{131}$	8 days
$Radon^{222}$	3.8 days

For survivors accurate exposure dose essential
Most difficult problem

Radiation quality
Time, distance, shielding
Isotopes involved (1/2 life)
Radio-protectors (KI)
Perception of radiation
Triage and counseling

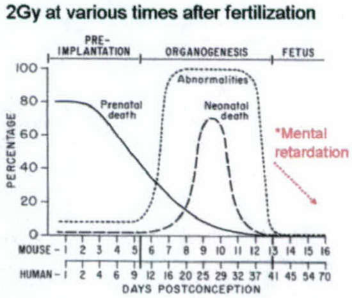
Dose to exposed individuals



No treatment
Antibiotics, transfusions, nursing
Potential for bone marrow transplants

Pregnant women at significant risk

2Gy at various times after fertilization



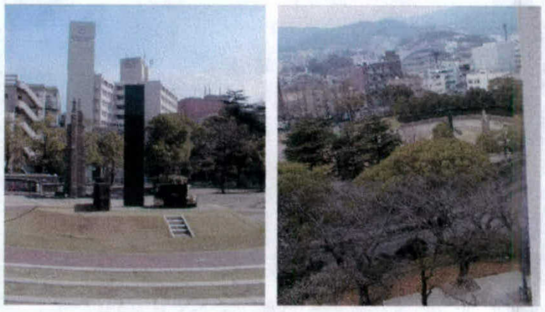
From: Hall, "Radiobiology for the Radiobiologist"

Long-term issues:

Survivor “perception”

Repopulation

Nagasaki, 2002



Attachment #2

MARYLAND POISON CENTER: ROLE IN RESPONSE TO CHEMICAL ATTACK

Bruce D. Anderson, PharmD, DABAT
Director
Associate Professor
UM School of Pharmacy

Overview: Maryland Poison Center

- Service program of the University of Maryland School of Pharmacy
- Respond to 60,000 calls per year
- Manage 35,000 human exposures per year
- Open 24 hours a day, 7 days a week
- Staffed by Specialists in Poison Information (pharmacists or nurses with additional training and certification in toxicology)

Overview: Continued

- Medical Director is board certified in Emergency Medicine and Medical Toxicology
- Director is board certified in Clinical Toxicology
- Data collection/reporting
- Perform public and professional education
- Perform research

MPC Mission

- The mission of the Maryland Poison Center is to decrease the cost and complexity of poisoning and overdose care while maintaining and/or improving patient outcomes.

Maryland Poison Center
University of Maryland School of Pharmacy

MPC Mission

- Save lives
- Save dollars

MPC Mission

- Save lives by providing emergency triage and treatment information to all callers.
- Save dollars by managing vast majority of patients (76%) safely and inexpensively at home.

Usual Population of poisoning victims

- 50-55% of all cases reported to the MPC involve exposures to children < 6 years old

MPC: Role in a Chemical Attack

- Information Resource:
  - One of the primary roles for the MPC is to provide information to assist in the management of toxic exposures.

MPC Role: Information Resource

- Initial assessment/triage
- Initial decontamination
- Assistance with substance identification
- Provide treatment recommendations, both for adults and children
- Assessment of antidote availability within local institutions
- Facilitation of antidote exchange between institutions

MPC Role: Information Resource

- Serve as a resource for media
- Resource for bystanders and other "worried well"
- Coordinate with state and local health departments and with local emergency resources
- Serve as data collection resource for subsequent public health investigation

MPC Role: Simulated Chemical Attack

- Explosion and victims detected near UMMS.
- Hundreds of victims stream into the ED
- Victims reporting symptoms inconsistent with pure explosive exposure
- MPC contacted by EMRC/hospital staff for assistance

MPC Role: Simulated Chemical Attack

- MPC gathers information on symptoms and patients, provides initial triage, decontamination and treatment recommendations based on "toxidrome".
- MPC faxes information on likely substances involved with specific treatment recommendations to UMMS staff
- MPC contacts UMMS hospital pharmacy for stock info for antidotes

MPC Role: Simulated Chemical Attack

- MPC provides specific dosing information for adults and children to ED and pharmacy staff
- MPC helps coordinate transfer of additional antidote from other local health care facilities
- MPC contacts state health department to inform them of situation
- MPC responds to numerous calls from those near explosion site and from worried well.

MPC Role: Simulated Chemical Attack

- Respond to increased call volume by bringing in additional MPC staff
- Provides information to media on substance(s) involved and expected effects in surrounding populations
- Document exposure cases as well as information calls

Post FRED

- FRED pops up with an alert notifying community of an explosion near UMMS
- Hundreds of victims stream into the ED
- Victims reporting symptoms inconsistent with pure explosive exposure
- FRED alert goes out for assistance in identification of possible toxin

Post FRED

- MPC gathers information on symptoms and patients, provides initial triage, decontamination and treatment recommendations based on "toxidrome".
- MPC posts information on likely toxin and provides initial triage, decontamination and treatment recommendations based on "toxidrome" to FRED.

Post FRED

- MPC provides specific dosing information for adults and children to ED and pharmacy staff, then posts the same information at FRED.
- MPC helps coordinate transfer of additional antidote from other local health care facilities
- FRED alerts state health department
- MPC responds to numerous calls from those near explosion site and from worried well.

ATTACHMENT #3

U.S. Army Soldier and Biological Chemical Command

U.S. ARMY CHEMICAL BIOLOGICAL RAPID RESPONSE TEAM (CB-RRT)

CHEMICAL BIOLOGICAL RAPID RESPONSE TEAM

LTC George E. Steiger
Commander

MISSION

U.S. Army Soldier and Biological Chemical Command

- Established by the Army in response to Public Law 104-201, Section 1414, *Defense Against Weapons Of Mass Destruction Act of 1996*
- Mission: On order, deploy and establish a robust, integrated capability to coordinate, synchronize, and manage Department of Defense technical Chemical/Biological assistance in support of a designated Lead Federal Agency (LFA) or Joint Task Force (JTF) in both crisis and consequence management of a chemical, biological, radiological, nuclear incident or designated nation security "special event".
- Military support to LFA or Combatant Commander through Joint Forces Command:
  - Domestic Support:
    - JTF for Civil Support (JTF-CS)
    - 1st, 5th Armies (Response Task Force – East and West)
    - Service Response Force (SBCCOM)
    - WMD-CSTs/FEMA/FBI/USSS
  - Combatant Commander Support:
    - Augmentation of Joint Technical Augmentation Cell (JTAC) in support a JTF for Consequence Management (JTF-CM)

ORGANIZATION

U.S. Army Soldier and Biological Chemical Command

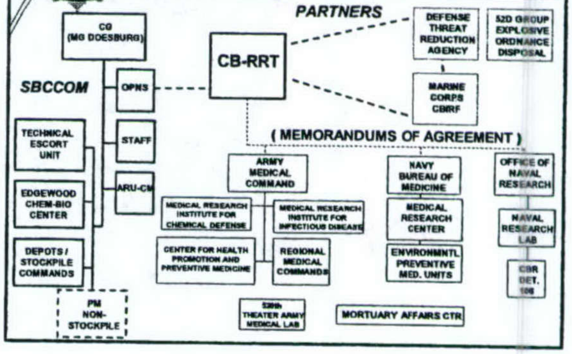
Communication Team	Operations/Plans Team**	Operations Center Support**	Command Support Team
1 x O3 25A (Signal) 3 x GS-12 1 x GS-11 1 x 31U40 (Commo) 1 x 74B40 (Network) 10 x Contractors	2 x O4 74B (Chem) 1 x MSG 54B (NBC) 1 x MSG 92Y (Supply) 1 x MSG 55D (EOD) 1 x SFC 91W (Medical) 1 x SFC 54B (NBC) 2 x Contractors	1 x O5 74B (Chem) 1 x MSG 54B (NBC) 1 x SFC 55D (EOD) 1 x SFC 54B (NBC)	1 x O6 74B (Chem) 1 x GS-11 1 x GS-09 1 x Contractor

Not Filled:
1 x O5 70H67 (Medical)
1 x O4 70H67 (Medical)
1 x O4 91E (EOD)
1 x O3 92A (QM)

***Expands when deployed upon task organization and/or augmentation with partner elements based on mission*

CB-RRT PARTNER NETWORK

U.S. Army Soldier and Biological Chemical Command



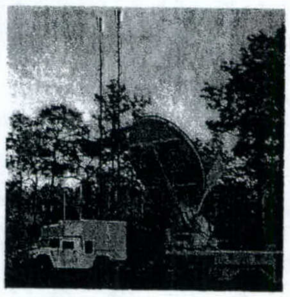
CB-RRT DEPLOYMENTS

U.S. Army Soldier and Biological Chemical Command

- Multi-service technical augmentation (chemical-biological-medical) and management of Chemical/Biological response assets to military Joint Task Force (JTF) or Lead Federal Agency.
  - Presidential Inaugural, (JTF-I), Washington, D.C., JAN 01
  - GB Bomblet Disposal, Rocky Mountain Arsenal, JAN 01
  - Exercise "Wasatch Rings", (FBI, Federal Emergency Management Agency), Salt Lake City, UT, APR 01
  - Exercise "Unified Defense", (Joint Forces Command), Norfolk, DEC01
  - Exercise "Cascade Shift", (RTF-W), Ft Lewis, WA, JAN 02
  - Operation Enduring Freedom, Augmentation of JFCOM Joint Technical Augmentation Cell support to Central Command, DEC 01 – MAR 02
  - Joint Task Force – Olympics, (JTF-O), Prepare to Deploy Order, FEB 02
  - 3D Civil Support Team (Weapons of Mass Destruction) Exercise, Lewistown, PA, MAY 02
  - Exercise "Blue Advance 02", (JTF-CS), Tampa, FL, Sep 02
- Reach-back for technical expertise.
- Integrated Chemical/Biological information management system.

DEPLOYABLE COMMUNICATIONS CENTER (DCS)

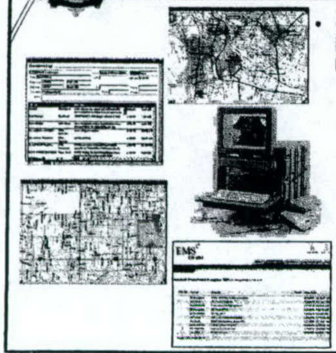
U.S. Army Soldier and Biological Chemical Command



- Stand-alone, dedicated cellular network
- Connects Federal, state and local responders
- DCS provides:
  - T1 bandwidth
  - Deployable local area network (LAN)
  - Independent 100 cell phone network
  - Remote video teleconference (VTC)
  - Secure and Non-classified Internet Protocol Router Network (SIPRNET and NIPRNET)

DEPLOYABLE RESPONSE GRAPHIC OPERATIONS NETWORK (DRAGON)

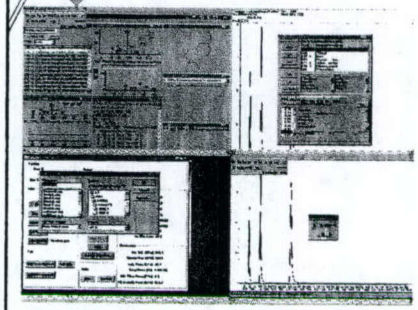
U.S. Army Soldier and Biological Chemical Command



- Complete Chemical/ Biological Information Management suite
  - Web-based remote access
  - Geographic Information data mapping overlaid on overhead imagery
  - Integrated Chemical/ Biological hazard modeling
  - Web-based operations log and asset tracking
  - Uses standard emergency management software programs

REMOTE INSTRUMENT ANALYSIS AND VTC REACHBACK

U.S. Army Soldier and Biological Chemical Command



"HAPSITE" Analysis, 3d CST (WMD) Exercise, May 02

•USING REMOTE ACCESS AND DCS, EXPERTS AT SBCCOM OPS CENTER CAN REMOTELY VIEW AND CONTROL ANALYTICAL INSTRUMENTS AT INCIDENT SITE.

•SIMULTANEOUS VTC PROVIDES REALTIME REACHBACK

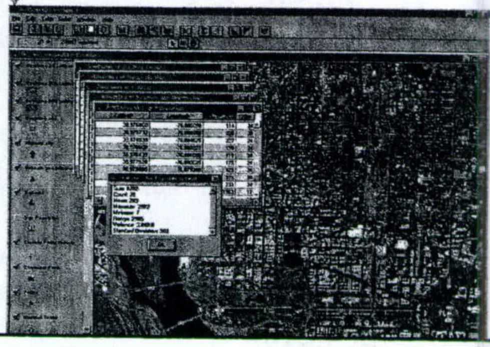
ARC IMS MODEL DISPLAY AND ANALYSIS

U.S. Army Soldier and Biological Chemical Command

ARC IMS allows planners to view multiple overlays of information necessary for planning response and recovery activities

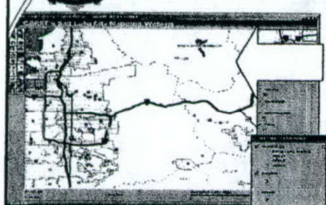
ARC IMS PLUME MODEL DISPLAY

U.S. Army Soldier and Biological Chemical Command

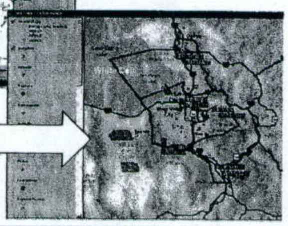


SITUATIONAL AWARENESS TOOLS

U.S. Army Soldier and Biological Chemical Command



Commercially available databases provide information relevant for consequence management operations



User defined / generated information can be added to any map, image or photograph allowing maximum flexibility

SUMMARY

- MULTI-SERVICE ***TECHNICAL AUGMENTATION*** (CHEMICAL-BIOLOGICAL-MEDICAL) TO MILITARY JTF OR LFA.
- ***REACHBACK*** THROUGH SUPPORT NETWORK FOR TECHNICAL EXPERTISE AND / OR FOLLOW-ON RESPONDERS.
- ESTABLISHMENT OF ***SATELLITE COMMUNICATIONS*** TO SUPPORT DATA, VTC AND VOICE; SECURE CAPABLE.
- RELIABLE AND PROVEN SYSTEM OF COMPREHENSIVE ***ELECTRONIC DATA MANAGEMENT.***

BACK-UP SLIDE

CB-R[illegible]ATION

Defense Against Weapons Of Mass Destruction Act of 1996

"The Secretary of Defense shall develop and maintain at least one domestic terrorism rapid response team composed of members of the Armed Forces and employees of the Department of Defense who are capable of aiding Federal, State and local officials in the detection, neutralization, containment, dismantlement, and disposal of weapons of mass destruction containing chemical, biological, or related materials".

SecArmy Memo 9 Jan 97

Appointment of a DoD Program Director for the Defense Against WMD Act of 1996

Directed the PD to recommend a structure for the CB Response Team outlined in PL 104-201

Director for Military Support (DOMS) Message 22 Jun 98

Mil Support to Civil Authorities

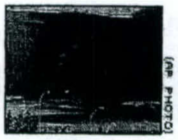
Established the CB-RRT Mission and Directed that SBCCOM provide the CB-RRT Commander and Staff

CB-RRT Approved Concept of Operations, 23 Sep 99

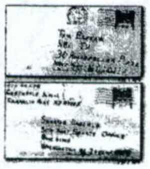
Established the CB-RRT Organizational Structure and Mission

Coordinated and staffed with DOMS and JFCOM, approved by Commander, SBCCOM

ATTACHMENT #4



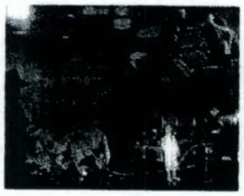
It's not a matter of if...
but when, where and...



with what?

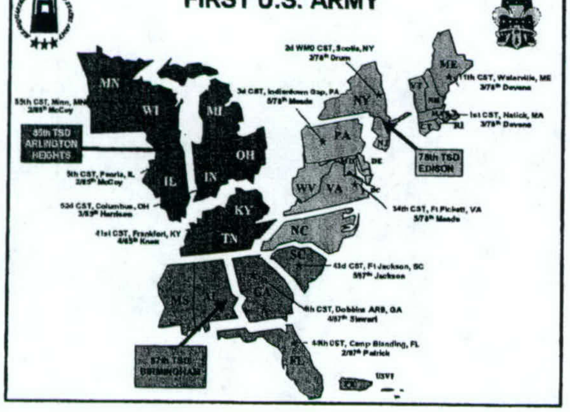
The Question for Our First Responders & Health Care Providers

- What was the agent?
- How do I treat it?
- How do I manage the incident?
- How do I isolate the contaminated area?



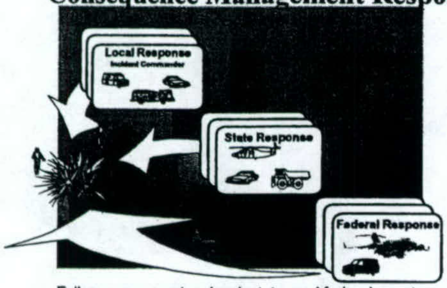
Although a
Presidential Declaration
may be automatic.....
It will be hours before
additional WMD assets arrive.

FIRST U.S. ARMY



Imagine what if....
Maryland had a
WMD Civil Support Team

Consequence Management Response



- Full response requires local, state, and federal assets
- State response includes National Guard
- Military support requires Total Force involvement

UNCLASSIFIED

COMPOSITION

of the Federally Funded WMD CST

UNCLASSIFIED

CST COMPOSITION

Personnel

- **Command Group**
  - **Operations Team**
  - **Comm Team**
  - **Survey Team**
  - **Medical Team**
  - **Administration and Logistics Team**

22 Personnel

15 Military Specialties

UNCLASSIFIED

UNCLASSIFIED

CST COMPOSITION

Equipment Overview (1 of 4)

- **Radiological, Biological and Chemical Detection and Personal Protective Equipment**
- **Unified Command Suite (UCS)**
- **Mobile Analytical Laboratory System (MALS)**
- **Medical Surveillance and Emergency Treatment Systems**
- **Decontamination Equipment**
- **Operational Support Equipment**

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UNCLASSIFIED

CST COMPOSITION

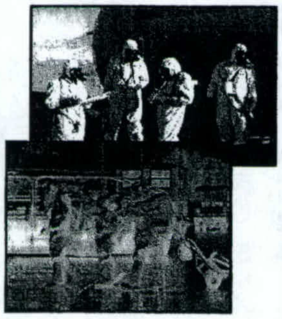
Equipment: Radiological and Biological Detection Equipment

Biological Detection

- **Bioassay Tickets**
- **Fluorescent Microscopy**

Radiological Detection

- **AN PDR 77 RADIAC Set** ***Detects Alpha, Beta, Gamma, X-Ray***
- **AN VDR2 RADIAC** ***Detects Beta and Gamma***
- **Gamma Spectrometer** ***Detects radiation level and identifies specific isotope***



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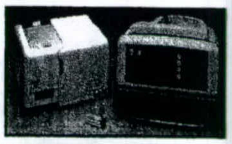
CST COMPOSITION

Equipment: Chemical Detection Equipment

Chemical Detection

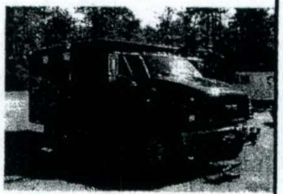
- **INFICON HAPSITE (GC/MS)** ***Detects 100,000 chemical substances***
- **DRAEGER COLORMETRIC TUBES**
- **MULTIRAE Photo Ionization Detector (PID)** ***Detects VOC, O2, H2S, CO***
- **ACADA/ICAM Detects** ***Nerve/ Mustard***
- **M256 Kit**
- **M8 Paper**



UNCLASSIFIED

CST COMPOSITION
Equipment
Unified Command Suite (UCS)

UNCLASSIFIED



- GMC 6500 Low Profile Chassis
- C-130, C-141, C-5, C1-17 Transportable
- 15 KW onboard generator
- Communications Capabilities
  - Military HF/VHF, AM/FM Transceivers
  - HF
  - VHF/UHF Base Station With Repeaters
  - Land Mobile Transceivers
  - INMARSAT B (UHF Voice/Data Satcom)
  - Commercial Ku Band Satcom
  - STE Secure Telephone
  - PC Workstations
  - Routers (Secure &Non-Secure)
  - Printer
  - Radio Remote Units
- Set-Up and Maintained by 2 Personnel
- Fully Operational Within 1.5 Hours of Arrival

UNCLASSIFIED

Reach-Back Architecture

UNCLASSIFIED

Reach-back Includes secure and non-secure voice, and data communications. It provides the Incident Commander and the CST with expert advice and assistance from national-level subject matter experts (SME) to include:

- Defense Threat Reduction Agency (DTRA)
- Soldier Biological, Chemical Command (SBCCOM)
- US Army Medical Research Institute for Infectious Diseases (USAMRIID)
- Center for Disease Control (CDC)
- US Army Medical Research Institute for Communicable Diseases (USAMRICD)
- Armed Forces Radiological Research Institute (AFRRI)
- Hazard Modeling SMEs and Others

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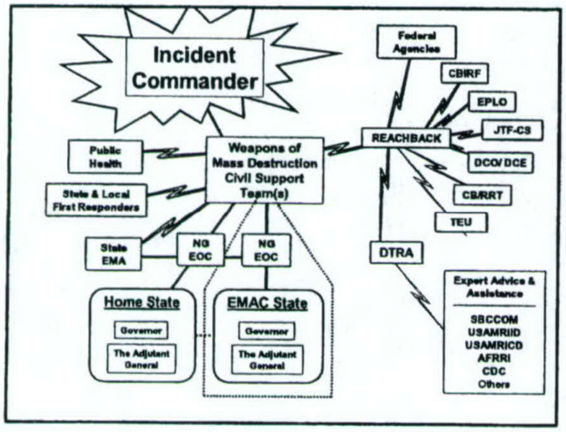

CST COMPOSITION
Equipment:
Mobile Analytical Laboratory System (MALS)

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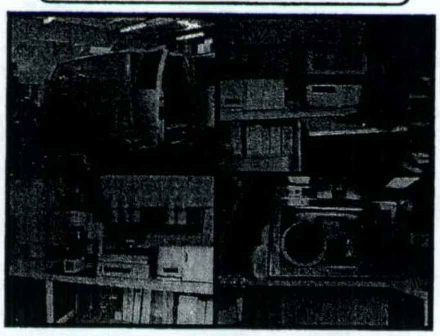
- HAPSITE system capable of detecting 100,000 volatile organic chemicals with Headspace Sampler for liquid/ solid samples
- Portable Gamma Spectrometer with Computer based Spectrum analysis system
- Digital Photographic Microscope linked to the Reach-back system
- Communications Linked to UCS
- Sample Analysis Prep-Shelter
- Sample Prep-Hood

Staffed by 2 Personnel

Operational 1 Hour from arrival

UNCLASSIFIED

Mobile Analytical Lab System (MALS)



CST COMPOSITION
Equipment
Medical Surveillance and Emergency Treatment System

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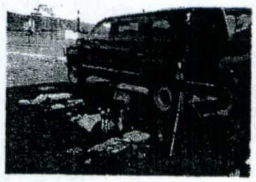
- Contaminated Patient Medical Treatment & Decontamination Sets
- Advanced & Basic Medical Treatment Aid Bags
- Digital Heat Stress Monitoring System



- Medical Science Chest
- Automated Reference Library (Nuclear, Biological, Chemical, and Radiological Information)
- Computer System

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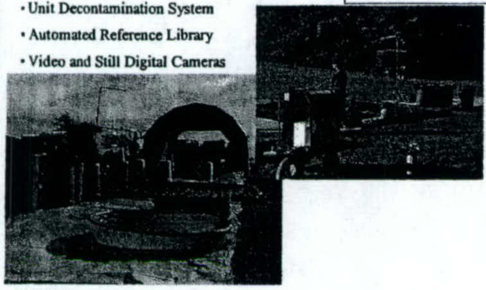
UNCLASSIFIED

Hazard Modeling and Operational Support Equipment

- Modeling and Simulation Computer System
- Unit Decontamination System
- Automated Reference Library
- Video and Still Digital Cameras



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Hazard Prediction Capabilities

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Hazard Prediction Assessment Capabilities (HPAC/CATS)

•Provides the CST the capability to calculate the dispersion of:

- **Hazardous Chemicals**
- **Biological Agents**
- **Radioactive Materials**

•Considers effects of:

- **Weather** (wind speed, direction, humidity, temp, barometric pressure)
- **Terrain** (natural and manmade)

• Produces:

- **Plume Model / "Street by Street" Hazard Prediction**
- **Predictions of lethal effects on population**
- **Recommendations for exclusion zone**

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HISTORICAL PERSPECTIVE

1997 "Tiger Team Report"

TAG directs the Maryland National Guard to create a "team" with expertise in Chem-Bio, nuclear medicine, operations, and communications to form a liaison with local and state emergency managers.

<u>1998</u> MDNG forms a WMD Civil Support Team (CST) Light <u>with internal resources</u> based upon a directive from the Department of Defense.

• Train with state/local HAZMAT Teams

• Team recognized by local officials, state Congressional and Legislative support

CRITERIA FOR SELECTION

•Targets that pose a threat to the nations infrastructure

- •Two power plants
- •Only 8 lane water tunnel in the world
- •Major cultural and sporting events with international attention
- •Major Defense Contractors and Federal Agencies

•Air Mobility for Regional Response

•Supporting Agencies

•DOD Assets in Maryland

•Political Support

•Strategic Location

FACTS TO CONSIDER

•Maryland is a key player if the Nation's Capital is attacked

•Marine Corp CBIRF moved to Maryland, however this is an international response asset for DoD that could be moved from the area at any time.

•FBI selected Maryland as command and control base

•7.2 million people within the Metropolitan Corridor (Baltimore/Washington)

•Many Federal Agencies and key infrastructure reside within Maryland

- <u>•Must be able to handle ourselves as with the recent Brentwood Post Office incident</u>

BOTTOM LINE

To be fully prepared to support a Terrorist or Weapons of Mass Destruction event, Maryland **must have** a Civil Support Team (CST).

•State of Maryland Certifications

•Known by local emergency and police community

•Ability to train together, share SOP's a major advantage

"Maryland has postured to receive a Team"

ANY ATTACK ON THE NATION'S CAPITAL WILL RESULT IN CONSEQUENCES FOR THE STATE OF MARYLAND.

WHAT WE CAN OFFER NOW!

- HAZMAT REINFORCEMENTS (First Responders-State Trained)
- FORWARD STAGING LOGISTICAL BASE SUPPORT
- ASSIST THE INCIDENT COMMANDER WITH EXPANDING COMMAND AND CONTROL OF RESPONDING STATE AND FEDERAL ASSETS.
- ADVISE INCIDENT COMMANDER OF AVAILABLE MILITARY SUPPORT

Our Status - *Training*

- All members HazMat Technician (MFRI)
  - Allows safe operations on civilian scenes
- Survey Leadership attended Tech Escort Course
- FEMA Radiation Courses
- Emergency Response to Terrorism: HazMat; ERT-Basic; ERT-EMS
- NBC Countermeasures - Ft. McClelland
- Medical Mgmt of Chem./Bio Casualties
- Combat Lifesaver

MD CST Personnel Composition

- Physicist (Ph.D.)
- Health Physicist
- NBC Officer for White House
- Physician
- Registered Nurse
- Chemical Engineer
- Public health emergency management planning
- Hazmat and fire service command experience
- Mass Fatality planning
- Law enforcement experience
- WMD detection instruments analyst (NWC)

Congressional Funding for a Weapons of Mass Destruction Civil Support Team for the Maryland National Guard

Historical Perspective

The threat of biological terrorism and the proliferation of weapons of mass destruction (WMD) have become a grave national security concern, and the cornerstone of many recommendations of force structure and missioning of the National Guard for the next twenty-five years. The Maryland Military Department has and continues to facilitate a significant effort to ensure that all persons involved in the response to, and recovery from, a terrorist incident are well prepared to manage the consequences.

In January 1998, the Department of Defense released the Tiger Team Report outlining recommendations for countering terrorism and the threat of weapons of mass destruction. This report outlined the National Guard's response to this threat and recommended the formation of Rapid Assessment Initial Detection (RAID) (now Civil Support Teams) in each state capable to responding and assisting local government with recognition and mitigation to WMD incidents. This requirement is rooted in Public Law 104-201, the National Defense Act of 1997, Title XIV.

Based upon this report and the recognized threat in the Baltimore-Washington Corridor, the Adjutant General of Maryland directed that a team be formed in the Maryland National Guard with expertise in Chemical-Biological detection, nuclear medicine, and communications. He further directed that this team form a liaison with local and state emergency managers, fire departments, emergency medical services, and others.

This twenty-two-person team was formed using internal resources and equipment. It began to obtain both federal and state certifications in hazardous materials, firefighting, and emergency medical services as required by DoD and local public safety officials. The Maryland National Guard team became a part of Maryland's State Response Plan and was quickly received by state and local public safety personnel.

By March 1998, several national level terrorism forums recognized the Maryland National Guard team as setting a standard and model for the entire nation. Maryland's congressional representatives and state legislators fully supported the formation of this team and the federal funding of a full-time CST in Maryland.

DoD Selections and Maryland National Guard CST Current Status

In December 1998, DoD released the names of the states that would receive the first ten CSTs based upon one team for each FEMA Region. By fiscal year 2000, additional DoD and Public Law criteria added another seventeen teams within the National Guard. The Maryland National Guard was not one of the first twenty-seven teams fielded. The two teams within FEMA Region III (MD, WV, VA, DE, and NJ) are located at Fort Indiantown Gap, PA and Blackstone, VA just outside of Petersburg.

The criteria used to select the placement of these teams was supposed to based upon:

(1) Targets that pose a threat to the nation's infrastructure.

(2) Access to air mobility assets for regional response.

(3) Other supporting agencies that could respond to a WMD incident.

(4) Political Support.

(5) The strategic location of the team in relation to the threat.

The Maryland CST, even though not resourced, has completed over 300 hours of training and includes a personnel composition unfound in the federally funded teams. The Maryland CST has a Ph.D. physicist, health physicist, and an NBC officer for the White House, physician, registered nurse, chemical engineer, and a Paramedic and Emergency Medical Services Administrator. Additionally, the team has HAZMAT and fire service command experience, mass fatality planning, law enforcement, and WMD detection instruments analysis training.

A CST for Maryland

The Hart-Rudman Commission (USCNS/21), a bi-partisan commission comprised of subject-matter experts from all fields, with significant input from the National Guard and DoD examined the requirements of national security for the next twenty-five years, taking into account technological advances and the sovereignty of states. The commission suggested that the role of the National Guard include:

Participation in local, state, and regional planning and response to a weapon of mass destruction, terrorist incident;

Training with and assisting local first responders;

Maintaining up to date resources and prepared to employ them on short notice, and;

Planning for rapid inter/intrastate response and reinforcement.

It is clear that in order to meet these goals that the State of Maryland must be equipped and staffed with a full-time WMD CST. The commission further concluded that the National Guard has the primary role in homeland

defense in the 21st Century and beyond, a role that it has traditionally prepared and trained for and that is consistent with the doctrine and statements of the Department of Defense. The role of homeland defense has been and it is recommended that it continue to be primarily a National Guard mission.

Although the Maryland National Guard has been a front-runner in WMD response, the Department of Defense has failed to fund nor recognized the requirements to fund a CST for the Maryland National Guard. Most recently, Under-Secretary Cragin stated that empirical data used by the DoD did not warrant the placement of a CST in Maryland. He stated that several DoD response assets within the State of Maryland had the ability to respond locally with their assets in a severe crisis. While these assets do exist, the commanders are limited to within a few miles of their facility and in some cases have agreements in place primarily to support fire suppression and emergency medical services. None of these entities is committed to a long-term support of a mass casualty consequence management incident as part of Maryland's first responders. Currently, all of these assets exist as follow-on support following a Presidential declaration. As Mr. Cragin has publicly stated, these assets are not appropriate for State response requirements.

> "Cragin said that the active duty Army and Marine Corps have their own WMD teams…These units, he said, are trained to respond to chemical, biological, or radiological attacks on federal installations and personnel. While the National Guard WMD teams are federally funded, trained, and doctrined, Cragin noted they come under state control, facilitating their rapid deployment to an incident site."
> Source: Armed Forces Press Service.
> 8 Dec 2000

Mr. Cragin's conflicting statements further suggest that the official opinion of the DoD is at best to support and at worst substitute federal response assets for local assets that are trained and managed locally on a regular basis.

Currently none of the federal assets is involved with a Memorandum of Understanding with the State of Maryland with regard to terrorism consequence management. It is important to note that none of these federal response teams will have the response time, flexibility, or the reliability that a National Guard CST, and the control of the Adjutant General can provide.

DoD Empirical Data Flawed

According to Mr. Cragin, an empirical analysis was used based on threat and population centers to distribute CST's throughout the United States. This does not appear to coincide with the actual distribution of these teams. The initial distribution of these teams closely mirrored the location of the FEMA regional offices, which are certainly not based on empirical threats related to terrorism. Though subsequent announced teams begin to cover population centers, they still do not provide adequate coverage to the State of Maryland. DoD relies on a 250-mile area of responsibility for each CST to ensure coverage for Maryland. As one can imagine, the chaos and panic associated with a catastrophic weapons of mass destruction incident will undoubtedly clog roads and access points and greatly increase response time. A 250-mile straight-line radius actually increases the driving distance to well over 325 miles. This, coupled with the effects on travel following a WMD incident could result in the delayed response of a neighboring state's CST by as much as 8-12 hours from the on-set of the incident, standards that are clearly unacceptable.

Facts to Consider for Placing a Civil Support Team in Maryland

Maryland is a primary response asset in the event that the Nation's Capital is attacked. This includes response into the District and with mitigation overflow into the state's boundaries.

The Baltimore-Washington Corridor is the home to approximately 7.2 million people and houses many key federal and state agencies as well as defense contractors and facilities. The state has a significant transportation system, comprised of an international airport, a state-owned general aviation facility, extensive public transportation, four major and over 2000 minor bridges, several interstates connecting the length of the East Coast with the rest of the United States, and other structures including the world's only eight-lane underwater tunnel for vehicular traffic. The State, its local jurisdictions, and private organizations host sports, entertainment, cultural, and convention activities that bring tens of millions of visitors to the State.

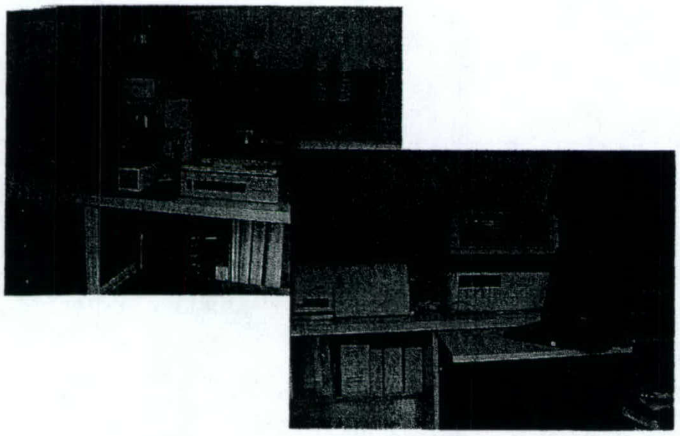
Various events of international importance have, and will continue to occur within the state due to its close proximity to the nation's capital. Other events of an unusual nature occur within the state to include inaugurations, parades, demonstrations, visits by heads of state, and other events that may be considered high-value by foreign and domestic terrorist groups.

What a Federally Funded CST Brings to Maryland.

A federally funded CST includes almost $5 million in equipment capable of radiological, biological, and chemical detection, to include personnel protective equipment.

A Unified Command Suite with communications equipment capable of integrating all personnel responding to the incident. This includes repeaters, INMARSAT, commercial SATCOM, secure telephones, personal computers, and secure and non-secure routers.

A Mobile Analytical Laboratory capable of detecting 100,000 chemical substances to include nerve and mustard gases.



This team has the immediate reach back capability with: The Defense Threat Reduction Agency; Soldier Biological, Chemical Command; The Centers for Disease Control, United States Army Research Institute for Communicable Diseases; and the Armed Forces Radiological Research Institute. Additionally the team can produce hazard models and make recommendations to mitigate and reduce the effects of the incident.

Better Positioned

The State of Maryland has reviewed the issues facing other jurisdictions, and feels that it is better positioned that any State previously considered for a Civil Support Team. The Maryland Military Department and the Adjutant General has aggressively worked to incorporate its National Guard response personnel into State and local response apparatus. They have trained with local response personnel and have achieved the level of Hazardous Material Technicians. Our National Guard has rode with these local responders to improve cooperation and has met with the Metropolitan Fire Chiefs to ensure their support and specifically identify their requirements for a Civil Support Team.

The facts supporting a funded Civil Support Team in the Maryland National Guard remain unchanged. Each community and state expects an immediate response, more so in an incident where hours allow a disaster to expand geometrically. Assurances made by many Federal organizations have provided false reassurances to the public, and especially Maryland's citizens, that capabilities exist to counter and respond to a weapon of mass destruction incident. A funded WMD Civil Support Team can provide Maryland a tremendous asset to support State and local responders-a task far too great for a Civil Support Team in a neighboring state and outside the role and responsibility of any federal asset within the State of Maryland. Locally trained and based Civil Support Teams remain the best National Guard multiplier in support of a State and local response-not federal assets designed and postured for national and international response.

Information Management During Major Emergencies

Introducing FRED

Information Conveyed

Advisement of an Incident
Spiral Call Down for Ed Availability

Unusual Occurrences Homicide

Information Conveyed

NDMS Drills
Anthrax Treatment Protocols
Resource Cataloging
Syndromic Surveillance
Patient Tracking
Poison Center

Current Methods of Conveyance

Voice via EMRC

FRED (Facility Resource Emergency Database)
Simplifying Current Operations

FRED

Web Vs Wire

Components - Alert Entry
Spreadsheets - ED Availability
ED Availability - Instant Entry
Spreadsheets - Pediatric beds
Medications and Equipment
Spreadsheets - NDMS Beds
EMS Unit availability
Prehospital Personnel
Prehospital Teams/Equipment
Spreadsheets - Psychiatric Beds
Components - Alert Log
Access Rights

Why FRED ?

Speed
Security
Reliable Information
Situational Update Log
Redundancy –
4th Level
multiple servers

System Requirements - MIEMSS

- Web Server
  - Programming
  - User Requirements
- Desk Top Computer
  - Internet Access
  - Web Browser
  - Sound Card

Where to Put FRED

- Individual Facility Decision
  - Multiple Simultaneous Access Points
  - One must be Active 24/7

When Will FRED be Active?

- Incident Driven
- Exercises
- Psychiatric Monitoring

Summary

- System preparedness
- Very Rapid
- Secure
- Reliable Information (can make decisions based on sound data)
- Situational Update Log (stay informed)
- Connectivity with other key system resources

Attachment # 6

A Picture is Worth
Ten Thousand Words
Mobile Video Assisted Coordination for **Rapid Response Teams**

Yan Xiao, PhD

Human Factors & Technology Research

Department of Anesthesiology

National Study Center for Trauma & EMS

A Possible Chain of Events

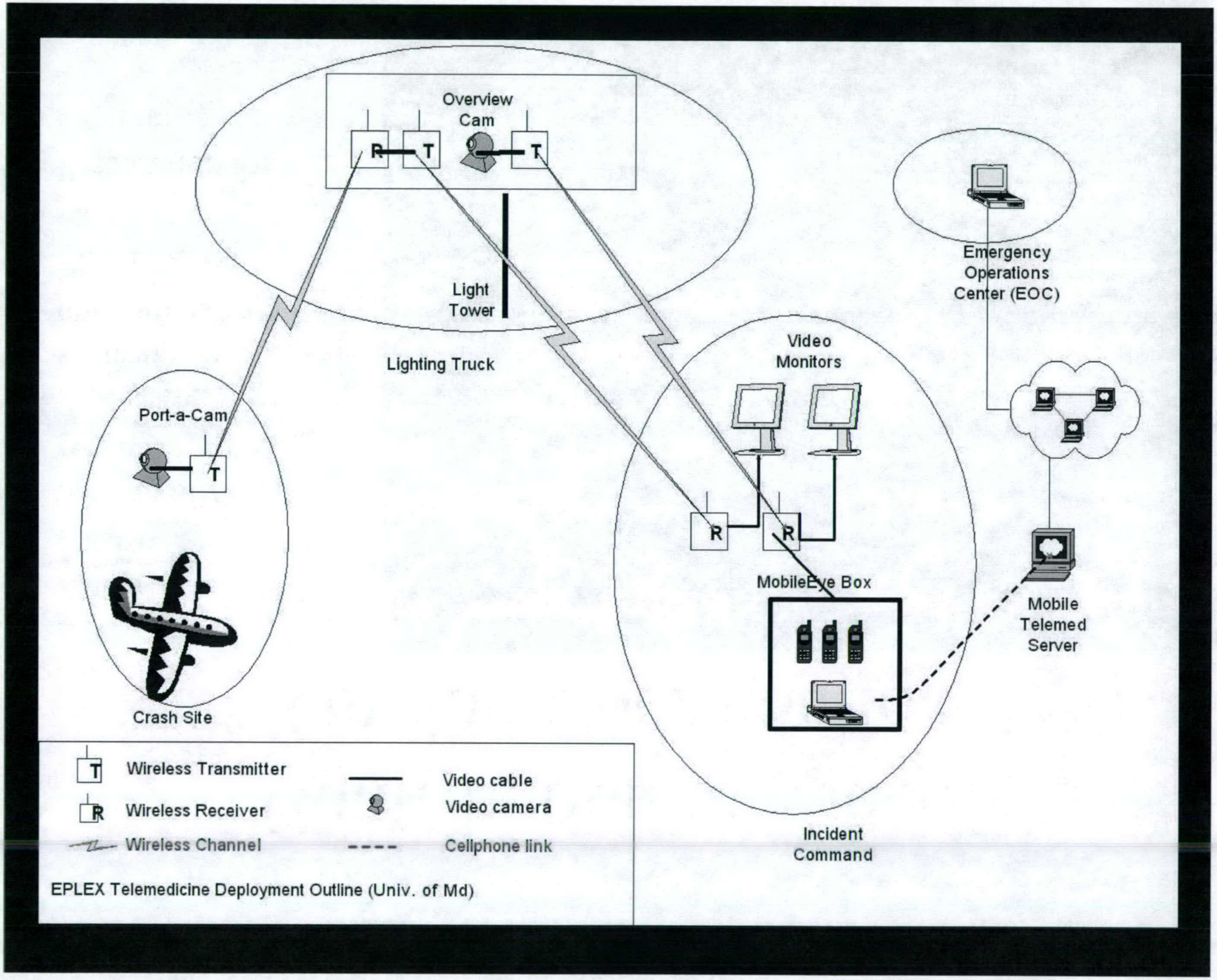
- Detection of Attack or Disaster
- Arrival of Rapid Response Teams (RRT)
- Assessing, securing, and containing site
- Planning for responses
- Preparation for receiving victims

On Site Coordination: Hazmat

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

On Site Coordination: Incident Command

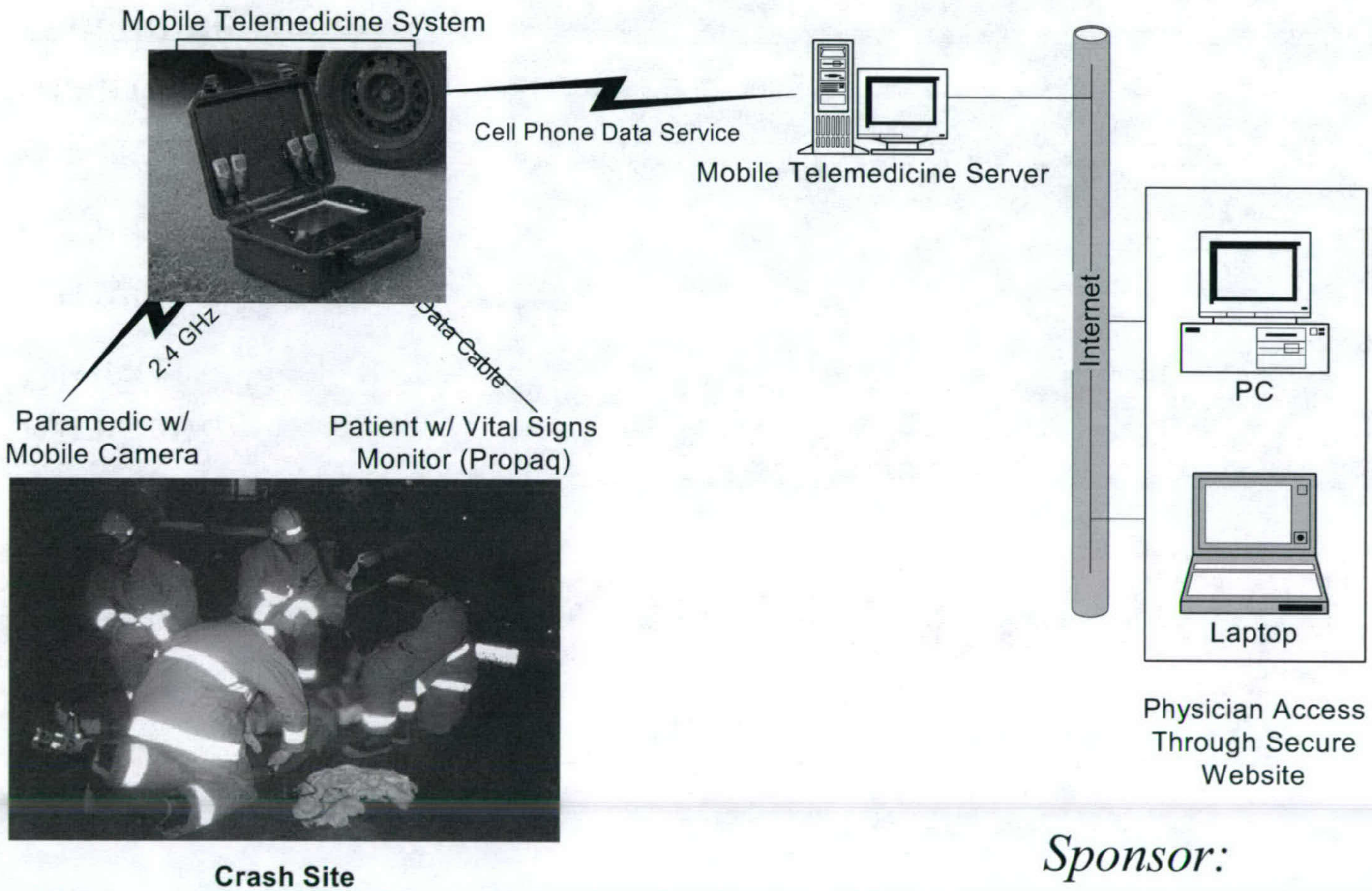
- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims


Overview Cam
R
T
T
Light Tower
Lighting Truck
Port-a-Cam
T
Crash Site
Emergency Operations Center (EOC)
Video Monitors
R
R
MobileEye Box
Mobile Telemed Server
Incident Command
T Wireless Transmitter
R Wireless Receiver
Wireless Channel
Video cable
Video camera
Cellphone link
EPLEX Telemedicine Deployment Outline (Univ. of Md)

Contribution of Video: On Site Coordination

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

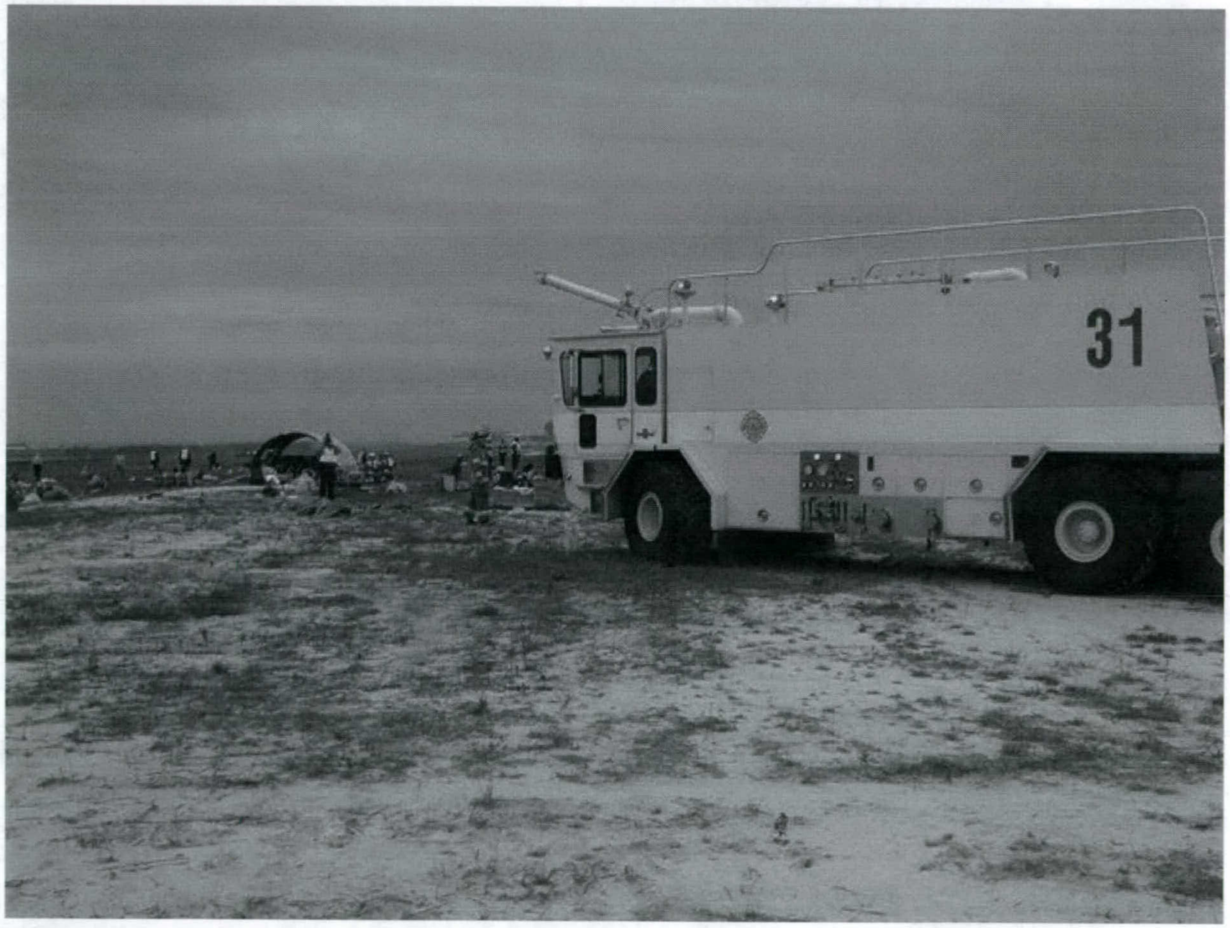
Regional Video-Assisted Coordination



Sponsor:
National Library of Medicine

Contribution of Video: Assessment of Progress

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims



Contribution of Video: Assessment of Progress

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

Contribution of Video: Assessment of Progress

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Contribution of Video: Assessment of Scale

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- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

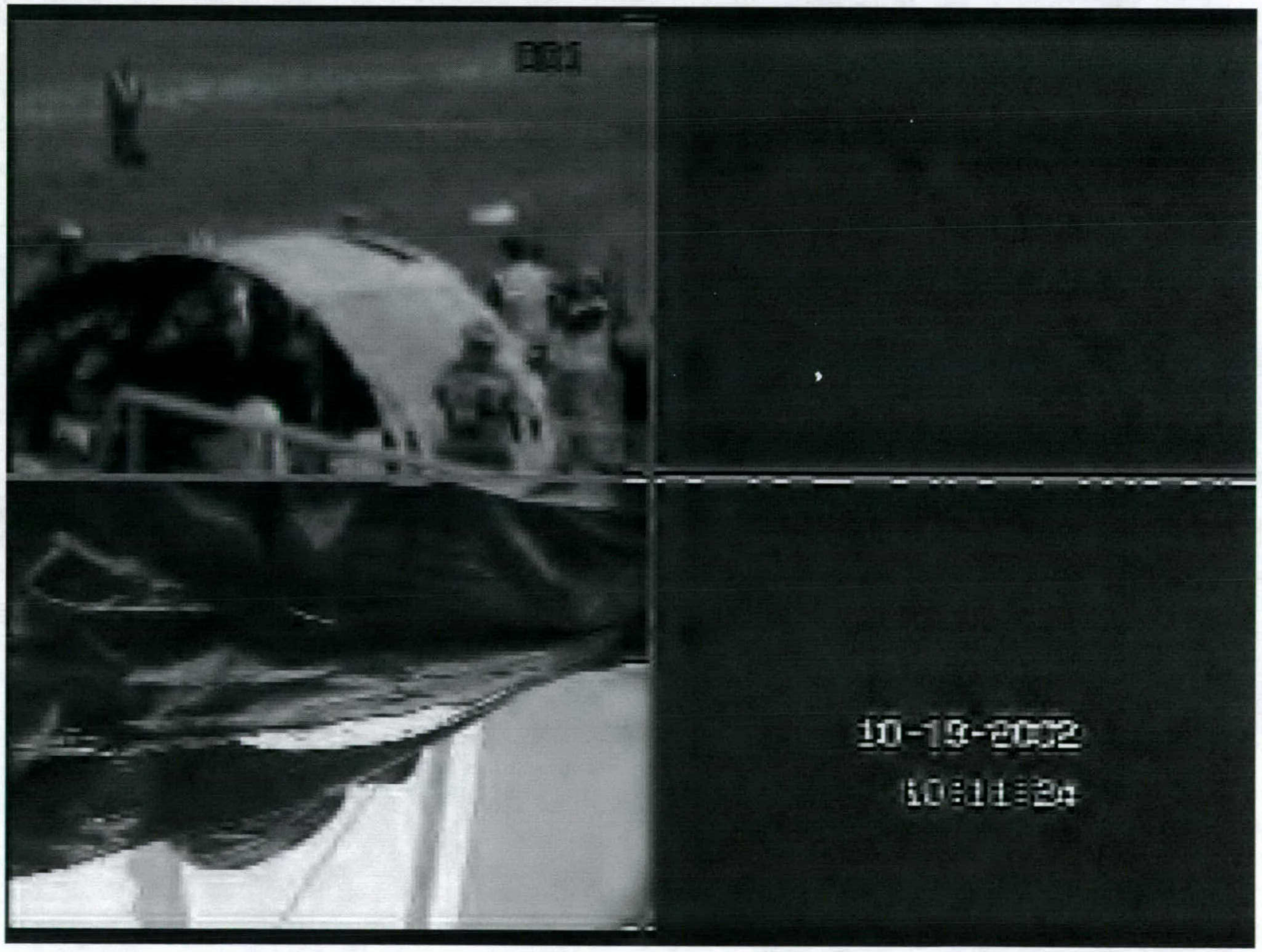
Contribution of Video: Assessment of Scale

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

User Interface

Contribution of Video: Preparation

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims



Contribution of Video: Preparation

- Detection of Attack or Disaster
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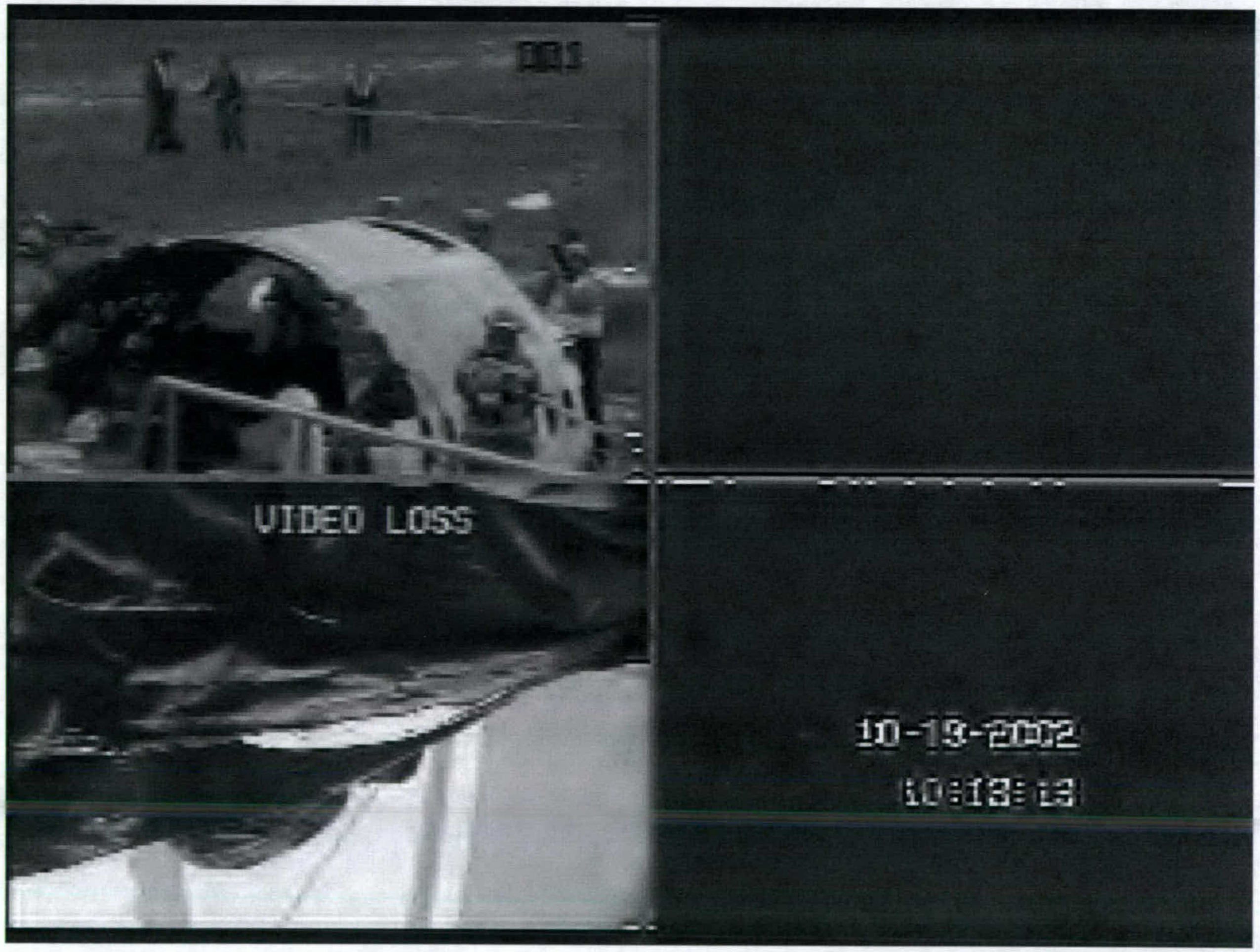
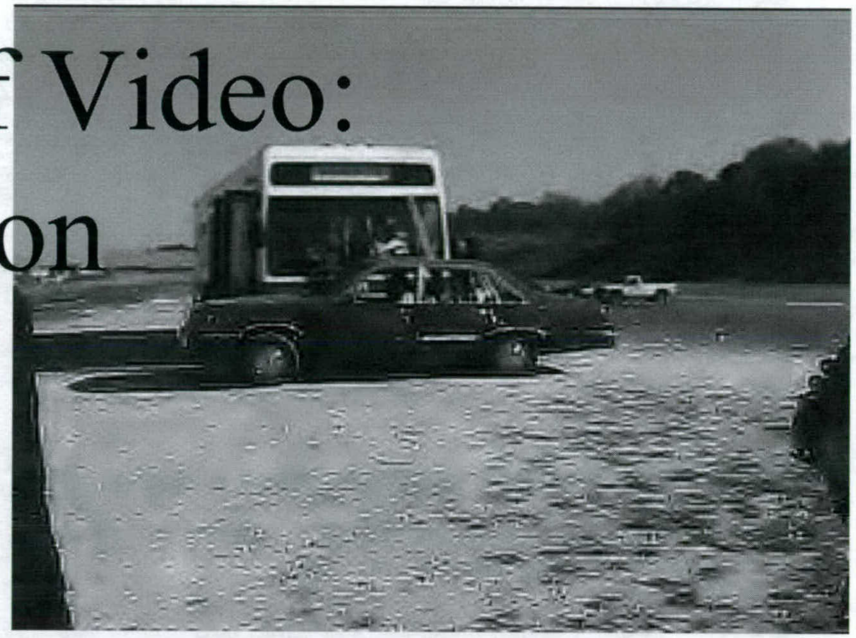
- Preparation for receiving victims



Contribution of Video: Preparation



- Detection of Attack or Disaster
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- Planning for responses
- Preparation for receiving victims

Contribution of Video: Preparation

- Detection of Attack or Disaster
- Arrival of rapid response teams
- Assessing, securing, and containing scene
- Planning for responses
- Preparation for receiving victims

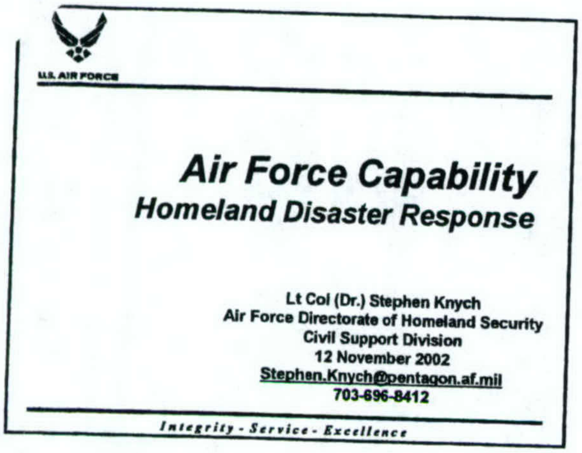
Video Sources and Distribution

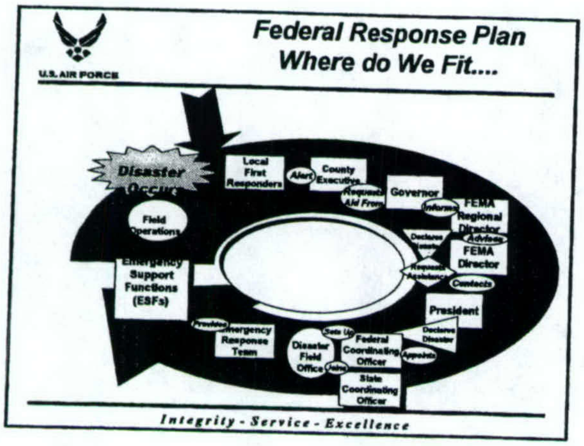
- Headcams
- Portable cameras
- High-mount vehicle cameras
- Helicopter-mount cameras
- Short-range RF transmission
- Long-range cellular/digital
- Microwave/Internet

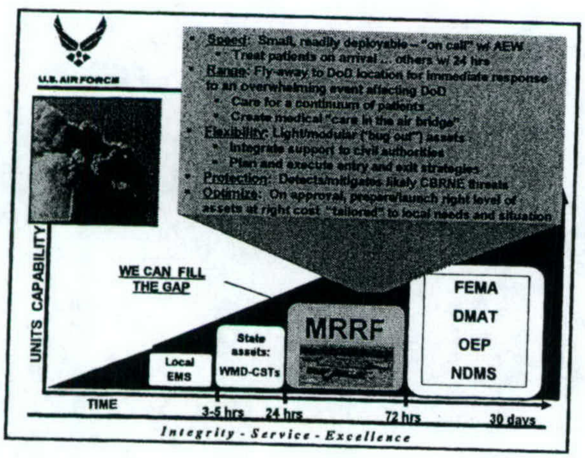
Video for Improved Coordination in Response to Disasters

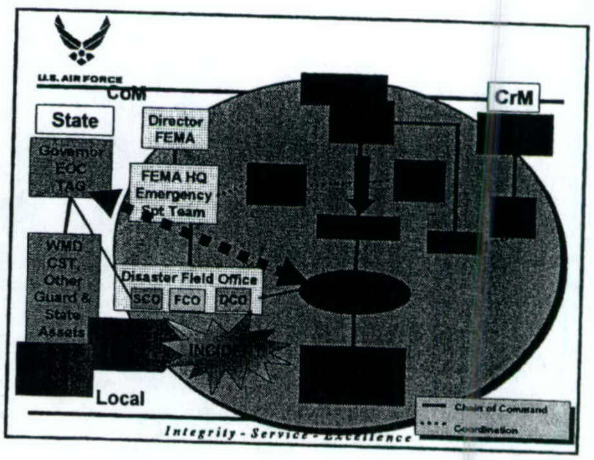
- On site coordination: wireless video network
- Regional coordination: assessment of progress, incident scope, nature of incident
- Specialty consultation: decision making requiring visual images
- Planning for responses: interfacing existing video conference links
- Hospital readiness: preparation for receiving victims

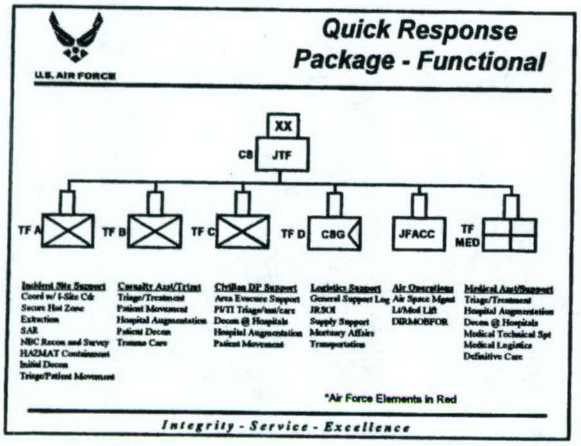
ATTACHMENT #7

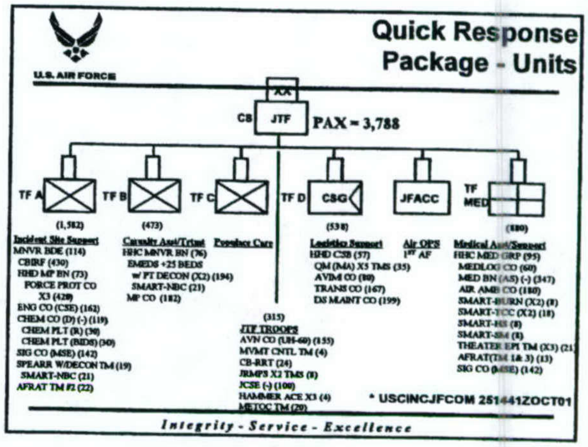









U.S. AIR FORCE
Quick Response
Package - Functional
XX
CB
JTF
TF A
TF B
TF C
TF D
CSG
JFACC
TF MED
Incident Site Support
Coord w/ I-Site Cdr
Secure Hot Zone
Extraction
SAR
NBC Recon and Survey
HAZMAT Containment
Initial Decon
Triage/Patient Movement
Casualty Asst/Trtmt
Triage/Treatment
Patient Movement
Hospital Augmentation
Patient Decon
Trauma Care
Civilian DP Support
Area Evacuate Support
PI/TI Triage/tmt/care
Decon @ Hospitals
Hospital Augmentation
Patient Movement
Logistics Support
General Support Log
JRSOI
Supply Support
Mortuary Affairs
Transportation
Air Operations
Air Space Mgmt
Lt/Med Lift
DIRMOBFOR
Medical Asst/Support
Triage/Treatment
Hospital Augmentation
Decon @ Hospitals
Medical Technical Spt
Medical Logistics
Definitive Care
*Air Force Elements in Red
Integrity - Service - Excellence


U.S. AIR FORCE
Quick Response
Package - Units
XX
CB
JTF
PAX = 3,788
TF A
TF B
TF C
TF D
CSG
JFACC
TF MED
(1,582)
(473)
(538)
(880)
Incident Site Support
MNVR BDE (114)
CBIRF (430)
HHD MP BN (73)
FORCE PROT CO
X3 (420)
ENG CO (CSE) (162)
CHEM CO (D) (-) (119)
CHEM PLT (R) (30)
CHEM PLT (BIDS) (30)
SIG CO (MSE) (142)
SPEARR W/DECON TM (19)
SMART-NBC (21)
AFRAT TM #2 (22)
Casualty Asst/Trtmt
HHC MNVR BN (76)
EMEDS +25 BEDS
w/ PT DECON (X2) (194)
SMART-NBC (21)
MP CO (182)
Populace Care
(315)
JTF TROOPS
AVN CO (UH-60) (155)
MVMT CNTL TM (4)
CB-RRT (24)
JRMPS X2 TMS (8)
JCSE (-) (100)
HAMMER ACE X3 (4)
METOC TM (20)
Logistics Support
HHD CSB (57)
QM (MA) X5 TMS (35)
AVIM CO (80)
TRANS CO (167)
DS MAINT CO (199)
Air OPS
1ST AF
Medical Asst/Support
HHC MED GRP (95)
MEDLOG CO (60)
MED BN (AS) (-) (347)
AIR AMB CO (180)
SMART-BURN (X2) (8)
SMART-TCC (X2) (18)
SMART-HS (8)
SMART-SM (8)
THEATER EPI TM (X3) (21)
AFRAT(TM 1& 3) (13)
SIG CO (MSE) (142)
* USCINCJFCOM 251441ZOCT01
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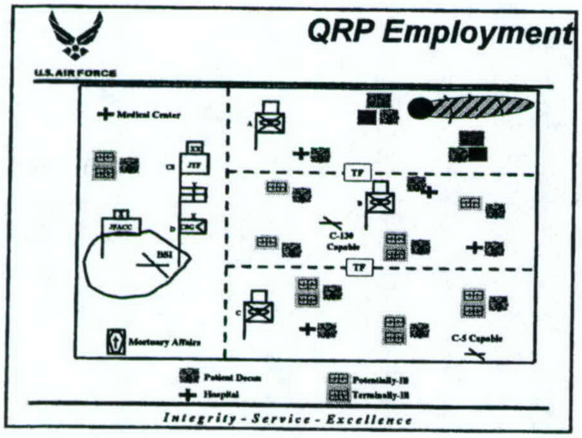
U.S. AIR FORCE
QRP Employment
Medical Center
XX
CB
JTF
JFACC
CSG
TF
C-130 Capable
C-5 Capable
Mortuary Affairs
Patient Decon
Hospital
Potentially-Ill
Terminally-Ill
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U.S. AIR FORCE
AFMS MRRF/QRP
[redacted]
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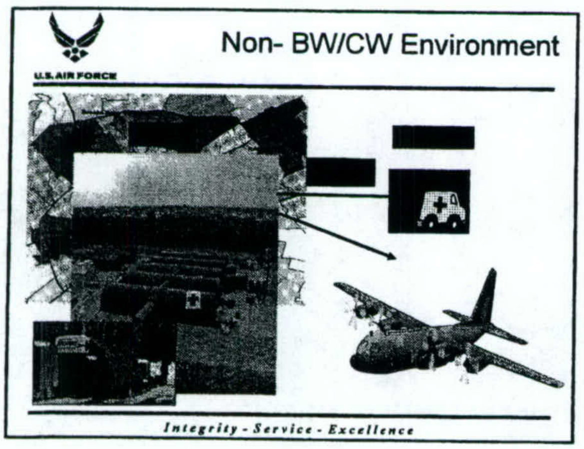
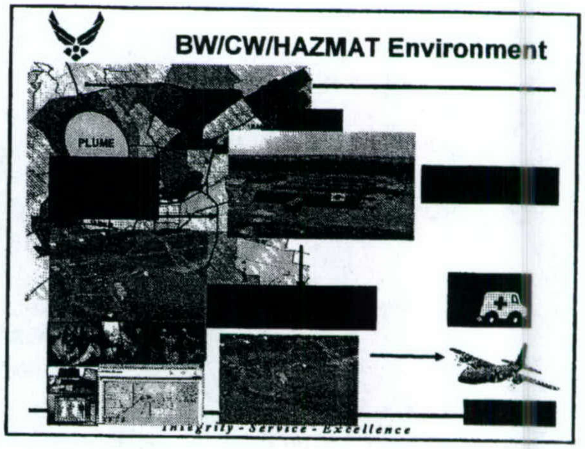

U.S. AIR FORCE
Non- BW/CW Environment
[redacted]
Integrity - Service - Excellence


BW/CW/HAZMAT Environment
PLUME
[redacted]
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U.S. AIR FORCE

Infectious Disease Team FFHA2/5

- Identify and control infectious diseases
- Missions/Tasks
  - Supports EMEDS (+25)
  - Medical surveillance
  - Specialized care contagion control
  - Infectious disease clinicians
- 2 echelons
  - FFHA2
    - 15 personnel; 8 officers, 7 enlisted
  - FFHA5
    - Augments FFHA2, 2 officers
- 5 Teams

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Biological Augmentation Team FFBAT

- Advanced diagnostic identification
- Missions/Tasks
  - Analyze clinical/environmental samples
  - Presumptive pathogen identification
  - PCR-based test results in hours
  - RAPIDS and JBAID
  - Tailored response: stand alone (with BOS) or augment EMEDS
- 2 laboratory personnel
  - 1 officer
  - 1 NCO
- 35 Teams by FY05
- Team responded to NYC – highly accurate testing of anthrax specimens

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U.S. AIR FORCE

BEE NBC Team FFGL1

- NBC surveillance, detection, risk assessment
  - Command element augmentation
- Missions/Tasks
  - Advise Commander/SRC through risk assessment - uncertainty management
  - Acute NBC and long-term low-level assessment
  - Augment CE NBC Detection Teams
- 6 personnel
  - 1 Officer - SRC representative
  - 2 Enlisted - NBC Control Center
  - 3 Enlisted - BEE Detection Teams
- 33 Teams

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U.S. AIR FORCE

AF Radiological Assessment Team - FFRA1/2/3

- Nuclear/radiological incident response
- Missions/Tasks
  - Full-spectrum radio analyses
  - Measure, interpret, assess ionizing radiation; provide risk assessment
  - Field recon and laboratory confirmation
- 1 team, 35 personnel in echelons
  - FFRA1 Nuclear Incident Response Force; advon, 2 officers, 5 enlisted
  - FFRA2 Nuclear Incident Response Force; follow-on, 6 officers, 14 enlisted
  - FFRA3 Radioanalytical Assessment Team; officers, 8 enlisted
- New UTCs in development:
  - Field radiological exposure (dosimetry)
  - Radiological ADVON team

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Medical Patient DECON FFGLA/B

- Ambulatory and litter NBC casualty decontamination
- Missions/Tasks
  - 24 hour operation
  - Approximately 12 patients per hour
- Two UTCs
  - FFGLA is equipment
  - FFGLB is 19 enlisted personnel
- 57 teams

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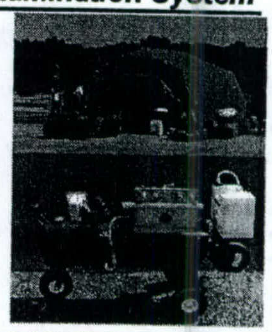
C-STARS Hospital-Based Decontamination System

- Shelter/showers/heater
- 2 ambulatory/1 litter lane
- Easily assembled/operated by hospital personnel
- Reeves Shelter/supplies stored at UMMC
- Available for training and use in disaster



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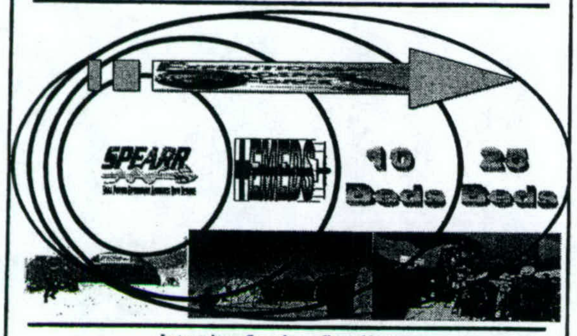
Expeditionary Air Force

U.S. AIR FORCE



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Prevention and Aerospace Medicine Team (PAM)

U.S. AIR FORCE

- Designed to prevent disease and non-battle injuries
- Missions/Tasks
  - Health threat/risk assessment
  - Health hazard surveillance, control, and mitigation of effects
  - Primary/emergency care, flight medicine
- Population at risk; 2-10,000
- 9 personnel in 3 modules
  - Module 1 (Advon) - Aerospace medicine physician, public health officer
  - Module 2 - Bioenvironmental engineer (BEE), independent duty medical technician
  - Module 3- 2 public health technicians, 2 BEE technicians, aerospace physiologist

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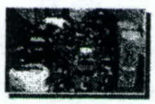
Mobile Field Surgical Team (MFST)

U.S. AIR FORCE

- Rapidly deployable, small surgical team
- Provide lifesaving trauma care within one hour of injury
- Personnel: 1-General Surgeon, 1-Orthopedic Surgeon,
  1-Emergency Physician, 1-Anesthesiologist, 1-OR Nurse/Tech
- Equipment: Manportable 300 lbs of medical equipment and supplies in 5 backpacks, 60lb generator, 1 folding litter
- Capability: Care for up to 20 patients in 48 hrs; perform up to 10 life or limb saving/stabilization procedures
- Operating conditions: Intended for specialized surgery tasks as stand alone for short periods or as medical augmentation unit; transportable by any means; uses shelter of opportunity; no patient holding capability



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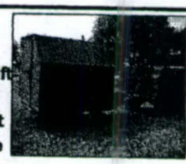
Small Portable Expeditionary Aeromedical Rapid Response (SPEARR)

U.S. AIR FORCE

- Deployable within 2 hours
- Flexible -- Highly Mobile (one pallet)
  - Sling Loadable -- not tied to a forklift
- Relatively Broad Scope of Care
  - Initial Disaster Medical Assessment
  - Emergency/Flight/Primary Medicine
  - Emergency Surgery (General/Orthopedic)
  - Critical Care/Transport Preparation
- SPEARR team deployed to Houston in support of the disaster (flood) response efforts



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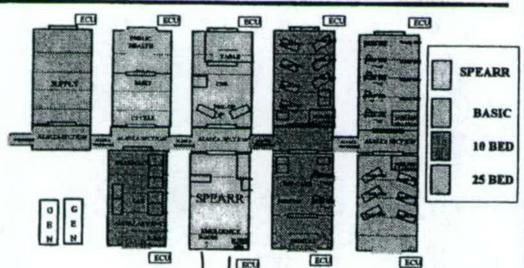
SPEARR/EMEDS/AFTH Modular Approach

U.S. AIR FORCE



Relies on base operating support

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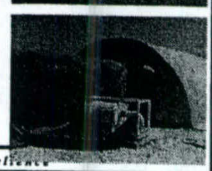
CHEMICALLY PROTECTED EMEDS (CP-EMEDS)

U.S. AIR FORCE

- Protects EMEDS against contamination by chemical/biological agents
- Preliminary Testing Successful
  - Oct 00 final design/engineering tests
  - Nov 01 initial operating capability
- Chemically Protected Assets Start at the SPEARR Level ***
- Preliminary Plan is to Centrally Store 10-12 +25 Sets
- 8 sets off production line '02
- Co-located with the 2 MRRFs



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SPEARR/EMEDS/AFTH Capability

Time Phased Patient Responsiveness

	SPEARR	EMEDS	+10	+25
PERSONNEL	10	25	56	87
PALLETS	1 (Trailer)	3	14*	20*
BEDS	3**	4**	10	25
PAR	500	500-2000	2000-3000	3000-5000
MAJOR TRAUMA SURGERIES / NON-OPERATIVE RESUSCITATIONS	10 or 20 in 48 hrs	10 or 20 in 48 hrs	10 or 20 in 48 hrs	20 or 40 in 48 hrs

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Critical Care Air Transport Team (CCATT)

- For Aeromedical Evacuation Patients
- Capability: Provides in-flight critical care transport of 3 ICU patients; with 2nd critical care nurse, 5 stabilized patients
- Personnel: 3 - 1 Physician, 1 Nurse, 1 Respiratory Tech
- Equipment: Light weight, compact, advanced and sophisticated patient management equipment and supplies
- Operating Conditions: Intended to work with 5 member AE crews to care for stabilized casualties and for tactical and strategic evacuation

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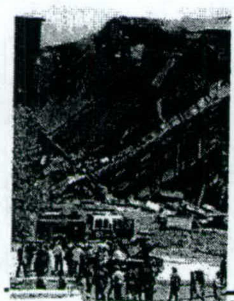
U.S. AIR FORCE

..."We sometimes chafe at the burden of our obligations, the complexity of our decisions,....



but there is no comfort or security for us in evasions, no solution in abdication, no relief in irresponsibility"...

- JFK

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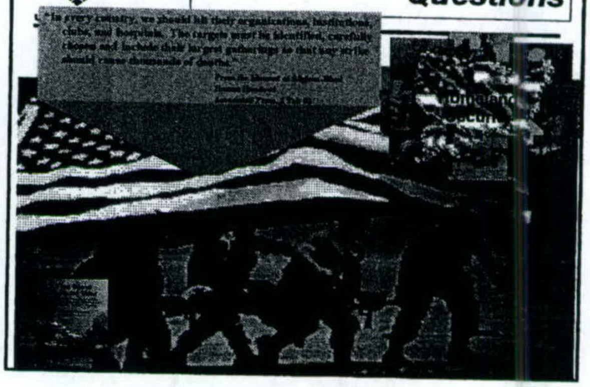
Questions



U.S. AIR FORCE

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U.S. AIR FORCE

TF A Requirements

TASK: Incident Site Support

- Secure Hot Zone
- Extraction
- NBC Recon and Survey
- Hazard Containment
- Initial Decon
- Triage/Patient Movement
- Search and Recover Remains

Supporting Elements

- HQ Maneuver Brigade
- Mobile Subscriber Equipment (MSE) Company (-)
- MP BATTALION (-)
- EMEDS (DS)
- CBIRF
- SMART-NBC
- CHEM CO (RECON)(-)
- CHEM CO (DECON)(-)
- HHC Engineer Battalion
- Engineer Company (CSE)
- TRANS CO

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TF B Requirements

U.S. AIR FORCE

Casualty Assistance /Treatment

- Triage/Treatment
- Patient Movement
- Hospital Augmentation
- Patient Decon
- Trauma Care
- Potentially Ill Assessment

Supporting Elements

- AEFT HQ
- HQ Maneuver Brigade
- Mobile Subscriber Equipment (MSE) Company (-)
- MP Company
- Medical Battalion (-)(DS)
- Medical Augmentees from CSH
- Expeditionary Medical Support (EMEDS)
- SMART-NBC x3
- SMART-TCC x3
- SMART-BURN x3
- Quartermaster Supply Battalion (DS)

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TF C Requirements

U.S. AIR FORCE

Populace Care

- Area Evacuee Support
- PI/TI Triage/treatment/care
- Decon at Hospitals
- Hospital Augmentation
- Patient Movement
- Extended Care

Supporting Elements

- HQ Maneuver Brigade
- Mobile Subscriber Equipment (MSE) Company (-)
- MP Company
- Medical Battalion (-)(DS)
- Medical Augmentees (100 pax)
- SMART-SM x3
- Quartermaster (GSS) Company
- Quartermaster (L&B) Company

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TF D Requirements

U.S. AIR FORCE

Logistics Support

- General Support Log
- JRSOI
- Supply Support
- Mortuary Affairs
- Transportation

Supporting Elements

- HQ Corps Support Group (GS)
- Mobile Subscriber Equipment (MSE) Company (-)
- MP Platoon
- Quartermaster Company (Mortuary Affairs)
- Quartermaster Supply Company
- Transportation Battalion (-)
- Engineer Company

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Area Assessment

U.S. AIR FORCE

Akron, OH
Albuquerque, NM
Amarillo, TX
Anchorage, AL
Atlanta, GA
Austin, TX
Bakersfield, CA
Baltimore, MD
Baton Rouge, LA
Beaumont,TX (SPOE)
Birmingham, AL
Boston, MA
Buffalo, NY
Charleston, SC (SPOE)
Charleston, WV
Charlotte, NC
Chattanooga, TN
Chicago, IL
Cincinnati, OH
Cleveland, OH
Colorado Springs, CO
Columbus, GA
Columbus, OH
Corpus Christi, TX
Dallas-Ft Worth, TX
Datona Beach Fl
Dayton, OH
Denver, CO
Des Moines, IA
Detroit-Warren, MI
Dover AFB, DE (APOE)
El Paso, TX
Fresno, CA
Ft Wayne, IN
Grand Forks, ND
Grand Rapids, MI
Greensboro-Winston Salem, NC
Hartford, CT
Honolulu, HI
Houston, TX
Huntsville, AL
Indianapolis, IN
Jackson, MS
Jacksonville, FL (SPOE)
Kansas City, MO-KS
Knoxville, TN
Las Vegas, NV
Lexington, KY
Lincoln, NE
Little Rock, AR
Los Angeles, CA
Louisville, KY
Lubbock, TX
Madison, WI
McGuire AFB, NJ (APOE)
Memphis, TN
Miami-Ft Lauderdale, FL
Milwaukee, WI
Minneapolis-St Paul, MN
Mobile, AL
Modesto, CA
Montgomery, AL
Nashville, TN
New Orleans, LA
New York, NY
Newark-Jersey City, NJ
Norfolk-Va Beach, VA
Oklahoma City, OK
Omaha, NE
Orlando, FL
Philadelphia, PA
Phoenix-Glendale-Mesa, AZ
Pittsburgh, PA
Pope AFB, NC (APOE)
Portland, OR
Providence, RI
Raleigh-Durham, NC
Richmond, VA
Rochester, NY
Sacramento, CA
Salt Lake City, UT
San Antonio, TX
San Bernadino-Riverside, CA
San Diego, CA
San Francisco
Savannah, GA
Seattle, WA
Shreveport, LA
Spokane, WA
Springfield, MA
St Louis, MO
Stockton, CA
Sunny Point-Southport, NC (SPOE)
Syracuse, NY
Tampa-St Petersburg, FL
Toledo, OH
Tucson, AZ
Tulsa, OK
Washington, DC
Wichita, KS
Worcester, MA

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Additional QRP UTCs

U.S. AIR FORCE

- 1 AELT,1 CCT, 2 MASFs And 2 Flight Crews
  - Increases QRP personnel numbers by 13
  - 60th MDG lacks FFGL1 personnel (- UMD slot)
    - To Be Addressed at Next Week's Requirements Drill
    - POC: HQ AMC/SGX EDC: 14 Dec 01
- Moving /Creating New UTCs at Both QRP Sites vs. Utilizing the 375th Existing Assets
  - POC: HQ AMC/SG EDC: 14 Dec 01

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Quick Response Package (QRP) Lift Requirement

U.S. AIR FORCE

Total Move: 162 passengers and 34 pallets

2 C-17 aircraft loads from Medical Center
1 C-17 from Aeromedical Evacuation Hub

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U.S. AIR FORCE

[redacted]

- EMEDS+25 @ $2,580K each = 5160K
- Water Distribution System @ 80K each = 160K
- CP for SPEARR thru CP-EMEDS+25
- and CP WDS @ 420K each = 840K
- MFST @ 117K each = 234K
- CCAT @ 49K each = 98K
- PAM (all 4 projects) @ 166K each = 332K
- MASF @ ?? = ??
- $6,824

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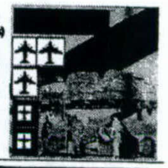
U.S. AIR FORCE

Current Status of Legacy System

- Old System - ATH
  - Covers needs in overseas locations
- Continental US is the "new battlespace"
  - Coverage is in planning stages
- EMEDS design provides rapid response w/ less airlift

	Pallets	Airlift
25-Bed ATH	55	4+C-17s (11 C-130s)
EMEDS+25	20	2 C-17s (4 C-130s)
EMEDS+10	14	1 C-17 (3 C-130s)
EMEDS Basic	3	1 C-130
SPEARR (full)	1	1 C-130
SPEARR (packs)	0	Pax Only



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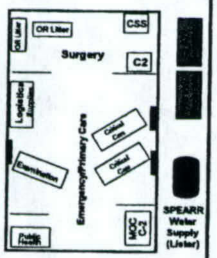
Modular Units of Capability: The First Block

Compact, Portable Medical Bags (Shelter Wall)

SPEARR Command and Control (Aeromedical Evacuation Team inside SPEARR Trailer)



SPEARR Shelter – 20 ft X 32 ft
Re-supply: 30 days

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U.S. AIR FORCE

Inpatient Capability

- Expeditionary Medical System (EMEDS)
  - 25 person package with medical, surgical, dental capability
  - Alaska Shelters, equipment, supplies for full EMEDS capability
  - Each increment (+10 & +25) is additional capability, not a whole assemblage
- CP-EMEDS (Collective Protection for EMEDS)
  - Additional liners, HVAC, accessories to "protect" an existing EMEDS
- Air Transportable Hospital (ATH) – Cold War era mobile hospital
  - Temper tents, ISO shelters, equipment and supplies for full ATH capability (50 beds)
- CHATH (Chemical Hardening for ATHs)
  - Additional liners, HVAC and accessories to "protect" an existing ATH

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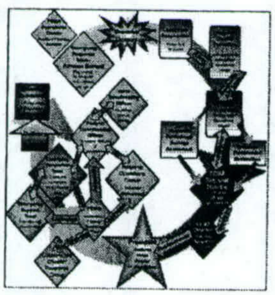
U.S. AIR FORCE

Getting There Matters...

As it stands right now...
DoD can't get there very easily!

When we do...
We bring a lot to the fight!



Integrity - Service - Excellence

U.S. AIR FORCE

Bio Concept of Support

National Pharmaceutical Stockpile
- Support reception of pallets at APOD
- Assist with breakdown of NPS
- Transport to whole sale distribution sites and assist with storage
- Assist with retail distribution of medicines and supplies to end users

Medical Augmentation
- Provide tailored packages of medical/support personnel to augment existing treatment or care facilities
- Provide tailored packages of medical/support personnel to establish additional assessment, treatment, or care capacity
- Augment medical facility support functions

Disease/Bio-containment
- Assist HHS and Center for Disease Control (CDC) with containment of the disease
- Assist with information collection and medical surveillance
- Assist civil authorities with contact tracing
- Support isolation or quarantine efforts to control movement within DOD authority
- Assist with vaccination program

Mortuary Affairs
- Assist with collection and transport of remains to temporary collection sites
- Assist with remains transport to designated storage facilities
- Assist with initial identification and cataloging of remains
- Support mortuary affairs material resupply

U.S. AIR FORCE

Building Block Concept

"Constraints Drove Adaptation, Innovation, Ingenuity"

Cold War Era: Heavy, Bulky, Expensive

Contingency Hospital

AF Air Transportable Hospital (ATH) (Transitioning)

Driving Forces:

Airlift Limitations/Types
Multiple Threats
Minimal Warning
Infrastructure

Solution Sets:

Time Phased Deployments
Predictability (People)

Key Words:

Lightweight
Mobile and Modular
Capable

Integrity - Service - Excellence

U.S. AIR FORCE

Expeditionary Packages

"Transformation Happened!"

- Prevention and Aerospace Medicine (PAM) Team
  - Designed to prevent disease and non-battle injuries
- Mobile Field Surgical Team (MFST)
  - Rapidly deployable, transportable, small surgical team
- Small Portable Expeditionary Aeromedical Rapid Response Team (SPEARR)
  - Deployable within two hours
  - Flexible, broad scope of care
- Critical Care Air Transport Team (CCATT)
  - For rapid aeromedical evacuation (AE) worldwide
- Expeditionary Medical Support (EMEDS)
  - New version of traditional Air Transportable Clinic / Hospital
- Biological Augmentation Team (BAT)
  - Field identification of pathogens of operational concern

Integrity - Service - Excellence

December 10, 2002

December 10, 2002

AGENDA

Local Area Biodefense/Surveillance

Meeting Date:	December 10, 2002	Place:	National Study Center For Trauma and EMS 701 W. Pratt Street Room 531 (410) 328-5085

10 a.m. Introduction of representatives from Baltimore City, Maryland EMS, Army, Air Force, Navy, Shock Trauma, Department of Health & Mental Hygiene (DHMH), University of Maryland Medical System (UMMS), University of Maryland, Baltimore Campus, National Study Center for Trauma and EMS, NSA and FEMA (to be confirmed)

Bio/Chem Radiation Sensors and their deployment at Albuquerque Airport

Jerry Stockton, Director, National Security Programs
National Security Technology Center
Pat Redmiles, Principal Chemist

Integration with Baltimore City Health Department Plans,
RuthVogel, Director, Terrorism Preparedness and Response

Local Area Biodefense (LAB) Demonstration: Funding Request and Objectives: Colin Mackenzie, Director, NSC

Disaster Plan for University of Maryland, Baltimore Campus
Pat Tate, Director, Facilities Management, UM, B

Sensors:
George Anderson, Center for Biomolecular Science and Emergency
Naval Research Lab, Washington, DC

Discussion on process for collaborations
(see attached scenario)

12 Noon Adjourn

Directions: From I95, take MLK Blvd., Exit, from MLK Blvd., take Pratt Street Exit, park in garage in first block on left on Pratt Street after exit from MLK Blvd. Bring parking ticket for validation. NSC is opposite garage at 701 W. Pratt Street, 5th floor.

Coffee, sodas and pastries will be provided.

Local Area Biodefense/Surveillance Meeting Notes
December 10, 2002
10:00 a.m. – 12 Noon

National Study Center for Trauma and EMS
701 W. Pratt Street
Baltimore, MD 21201

Participants

Baltimore City Health Department
Nkossi Dambita (nkossi.dambita@baltimorecity.gov)
Ruth Vogel, Director, Terrorism Preparedness, (ruth.vogel@baltimorecity.gov)

Baltimore City Medical Society and University of Maryland Specialty Hospital
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Center for Vaccine Development, University of Maryland
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Dyn Corp/National Security Programs
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Johns Hopkins University, CEPAR
Dianne Whyne (dwhyne@jhmi.edu)

Infectious Disease Control Officer, University of Maryland Medical Center
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Maryland Institute for Emergency Medical Services Systems (MIEMSS)
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National Security Agency (NSA)
Paul Buckmaster (pkbuckm@nsa.gov)

National Study Center for Trauma and Emergency Medical Systems
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Navy Research Lab
George Anderson, PhD, Research Chemist (ganderson@cbmse.nrl.navy.mil)

President Ramsay's Office, University of Maryland, Baltimore
Mary Leach, PhD (mleach@umaryland.edu)

University of Maryland, Baltimore Facilities Management
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University of Maryland Medical Center (UMMC)
Tim Ganous, Consultant, (tganous@umm.edu)
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University of Maryland School of Medicine/VA Medical Center
Craig Thorne, MD (cthorne@medicine.umaryland.edu)

United States Air Force
Shawn Varney, MD (smvarney@aol.com)

The meeting began by participants introducing themselves (see cover page). Dr. Mackenzie welcomed all present identifying the purpose of the meeting as 1) information on environmental sensors, 2) plans for a Local Area Biodefense Network at UM, B, 3) Description of UM, B campus emergency plan 4) Description of Baltimore City terrorism preparedness plans.

The agenda was shifted to allow Pat Redmiles' zip disk to be copied onto CD, so **Dr. Colin Mackenzie**, Director of the National Study Center for Trauma and EMS, began. First, he described the existing state of biosurveillance, including the Baltimore City Internet based daily surveillance of ambulance information, City ED (n=9) department chief complaints, Pharmacy Rx, absenteeism and dead animals. There were available rapid response teams (RRTs) at UM, B campus, including access to RRTs at the Shock Trauma Center (STC), MIEMSS, USAF, SPEAR Team at STC, and HAZMAT trained personnel at the Office of the Chief Medical Examiner (OCME) and Environmental Health Services HAZMAT Team. Command and Control for UM, B Campus is situated in the city (not MIEMSS this item corrected by Doug Floccare). They would make decisions about access to further resources (see slide #1 of Attachment #1 Colin Mackenzie's presentation).

The UM, B Campus contains important resources, including MIEMSS, the State EMS headquarters, the OCME, STC, Vaccine Research Center, UMMC and the Poison Center. Historical data identifies over triage as a major problem of previous terrorist attacks, e.g., 80% over triage rate after the Beirut bombing of 1983. The over triage rate is also directly related to the occurrence of immediate death from bomb blasts (data provided by Tom Scalea, MD).

So the current problems with biodefense against events such as bomb blasts or chemical agents such as Sarin and VX are 1) the federal or military rapid response teams with expertise in chemical warfare agents take 4-6 hours to deploy. Respiratory paralysis begins in minutes from Sarin or VX inhalation, 2) there are a lack of models for biodefense of terrorist targets to detect and respond to attacks, and 3) no civilian biodefense system exists in which to test environmental sensors or the coordinated effort of rescue services.

The aims are, therefore, to demonstrate a real-time detection and rapid response system for local area biodefense on the UM, B campus; to identify Rapid Response Team and community response performance i.e., can 50 ventilators and beds and staff for 100 patients be found within one hour, can we decontaminate 400 people? to develop strategies to cope with the psychological casualty and track those with physical injuries in need of emergency care, e.g., can we train a local community such as UM, B with an educational program to understand what is going to happened and gain control of the psychological casualties?

The desired outcomes from the demonstration project would be an immediate coordinated detection and response, with development of strategies to cope with the psychological casualties, while minimizing over triage and being able to track mass casualties. If we had the funding, we would also like to evaluate the data provided by the environmental sensors. The demonstration project such as included with the agenda (see slide #9 in Attachment #1) will identify assets and resources on campus and will identify guidelines for access so that reduplication of effort and redundancies between collaborators is avoided.

Because this is a request for funding from the military, the military relevance identified includes 1) a demonstration of collaboration between federal (Air Force), state, city and local agencies for a real-time detection and response system 2) performance measures for rapid response teams and a determination whether these would realistically save lives from chemical attack 3) test an

electronic triage tag and develop psychological casualty control strategies 4) demonstration exercise will include data on resources, access and utilization of area hospital beds and how easy it will be to mobilize personnel and equipment, 5) demonstration project would be a surrogate test bed for other potential, military and civilian installations.

Pat Redmiles of DynCorp presented next. The Defense Threat Reduction Agency (DTRA) was asked by the Homeland Security Office to develop the biodefense initiative (BDI). They have done nine months of work to develop a testbed at Albuquerque. Initial task for biodefense, not chemical, but a lot of sensors are actually better at chemical detection. Pat Redmiles described the set up in Albuquerque and discussed individual sensors that were chosen on the basis of effectiveness and what's available. Environmental monitoring applicable in airports, seaports, junctions of major highways and sensor data is used in conjunction with medical surveillance data. These data are integrated algorithmically into a visual display in a command center to provide data for first responders.

They started sensor deployment at Albuquerque in September 02 and they were planning to have completed this evaluation by 04 (see Attachment #2 for Dr. Redmiles' slides). BDI initiative may get completed faster than 04, but presently on hold. Medical surveillance includes non-traditional data sources such as pharmacy data, absenteeism and is integrated into sensor information.

Systems at Albuquerque

Portal Shield System (7ft tall, 6ft wide), autonomous unit for collection, detection to signify increase in particle count, a wet cyclone that goes to a buffer and so to an immunoassay strip with currently 8 agents on it. The results of the immunoassay are automatically read and transmitted to the control center. Not efficient, very large and expensive, but it exists to protect command center in the field, using 5-7 around the perimeter as an electronic network of detection.

RAPID is PCR analysis based. It is portable, 30 min analysis with PCR amplification. Gives specific information about the biological agent, and is designed for use by first responders.

BASIS Distributed Sampling unit was used in Salt Lake City during the Winter Olympics. Distributed collect and central analysis system based on PCR and immunoassay analysis. It is not good for wide area, but works well locally and is cost effective because of distributed sampling.

S3I is a new system based on UV fluorescence of aerosol particles. (S3I is based in Owings Mills, MD – costs $20K). Advantages over other UV fluorescence systems has been reduction in false positives. UV particle fluorescence detection cab be multiplexed to parts of air handling system indoors. It compares the ratio of two different wavelengths so increasing specificity. One hundred of these units would give coverage for 100-200 square km – a typical U.S. city size. Dry filtration units are just filters used in association with monitoring systems such as Portal Shield and they trigger remotely.

Autonomous Pathogen Detection System comes out of Lawrence Livermore Lab, very sophisticated. It collects and has a trigger detector. APD System uses immunoassay tickets and flow cytometry to do its analysis, very expensive (about $300K/unit) and requires a lot of maintenance. This just installed in October 2002, so no track record of their field performance.

This week, 12/11/02, starts the system up at Albuquerque– the official exercise. Some historic data from filters is being analyzed for normal biologic background.

Rapid PCR requires centrifuge of sample and 30 min for PCR analysis of 6 agents simultaneously. Designed as a response system for first responder at site for on site verification that a biological attack occurred. Also used for medical diagnostics. Lawrence Livermore has a Relocateable Field Laboratory, dispatchable within 24 hours. It has full PCR and immunoassay, robotic sampling preparation and capable of 300 samples/day. Can be delivered to any site with power in 24 hours.

Dry filtration units collect particulates and are controlled remotely. Environmental sensors can be mapped with GIS network, so the first responders can identify where the trigger occurred. Challenges are for Integration, selection of sampling locations and identifying and reducing false positive triggers.

Technologies for environmental monitoring are either particulate based (filter collection) or UV fluorescence as a trigger detector. More complicated is to get the sample into a liquid, e.g., for immunoassay or PCR based analysis to determine what the organism is. Other types of detection may work in the lab, but not necessarily in the field. Small mass spectrometers work well for environmental monitoring of chemicals, but not so effective with biological, because of the large biologic particles. Other techniques may look promising, but not reliable.

Q: What are the agents/specificity/sensitivity?

A: The immunoassay strips include agents on the CDC lists A-C, including anthrax, smallpox, plague, tularemia, brucellosis, but no hemorrhagic fevers. The sensitivity and specificity is not perfect, there are inhibitors that can cause problems with the immunoassay. False negatives may also occur due to naturally occurring substances, as well as false positives. Most lab protocols pair immunoassay with PCR testing. The quality of the antibodies used and how the immunoassay was produced can also affect the detection capabilities.

Q: How about the ability to detect the toxins?

A: A lot of these approaches can detect the toxins – some of the devices are set up for toxins – unknown reliability.

Q: How robust are these devices, how resilient to weather, sabotage, etc.?

A: Weather is the first consideration – designed to be resistant. In terms of sabotage vulnerability – you need to have a large array of environmental sensors, so that knocking out the entire system is difficult – redundancy will usually overcome this. Despite command center being hit, these sensors function and can be remotely accessed. Cost is the biggest problem. If you need to know the species of the biological particle- it is expensive and high maintenance. If you want a trigger that identifies something anomalous in the atmosphere, that is more affordable and practical.

Q: Maintenance?

A. The immunoassay tickets are relatively delicate and need looking after and it is a significant problem. UV fluorescence detectors are a different situation because it is pass-through airflow.

Only monthly simple maintenance is done. There are still significant challenges; we may be a decade away from a real effective, accurate, reliable biodetection system.

Q: If sensors are in different parts of the city and an attack occurs in two places – alarms in system with mobilization – how do we deal with this?

A: Operating sensors by themselves do not function without back up by surveillance data. For biologics, such a rapid first response is not required, prophylaxis can begin later than for chemical events. The sensors give confirmation of the event. The confirmation is validated by further analysis of filter-captured material. The immunoassays are considered to able to discriminate different organisms, but in practice, there may be some anomalies. Interference simulants are built into some terrorist bioagents to confuse the sensors. These systems are focused on biologic detection, but chemicals can be mixed. A detector system that works for aerosolized anthrax may be useless for smallpox, since aerosolized delivery of smallpox is difficult and unlikely. A truly universal biodetector is "Star Trek" technology.

Ruth Vogel, Director of Terrorism Preparedness and Response, Health Commissioner's Office, Baltimore City. I was asked to come here today to consider what the city is doing abut terrorism preparedness, what we are doing, what our initiatives are. We had a meeting last week with hospitals CEOs, and other emergency preparedness personnel. (See Ruth Vogel's slides as Attachment #3). Slide 2 shows the overview of the briefing. To enhance communication, about City plans you can be placed on the list server. Forward your e-mail address to Ruth Vogel. Website currently showing updates on smallpox – shifting into a surveillance mode. In the city there is an internal "advisory board" and also external medical advisors board that will meet on a quarterly basis. The various agencies such as fire, police and health will be working together on exercises. The city is on the way to get a unified command system through the Mayor's Joint Executive Committee, which includes leaders of the various agencies to decide what needs to be prioritized in terms of emergency response. All activities are in preparation for Spring Break exercise. See slide #3 for participants. Ms. Vogel suggested MEMA should be involved in these meetings. Exercise can include lists of ideas that could be tested and these meetings are being used to get everyone aware. Teaching is an important part of the process. Exercise goals are shown on slide #4. Integrating private and public response plans, e.g., NSC, Maryland State – how will all these plans come together? City will have to take control. How do fire department command systems integrate with City, etc?. Jurisdiction boundaries have to be considered (tape change).

Expectations from field exercise is ultimate test of the coordination activities, communication, meetings and planning over the next few months.

Working closely with Mayor's office and hospitals the city has initiated a letter signed by the Spring exercise participants. The efforts are to position the city to do this exercise.

Q: Planning for drill. Are you planning to survey the health care institutions about plans and sharing training?

A: Health Department liaisons started last week to work with volunteers in the hospitals to get copies of internal disaster documents.

Q: And similarly for training?

A: Same thing with training. This will be discussed at Healthcare Systems Subcommittee Meeting.

Comment: The U.S. Air Force has an impressive array of training programs prepared for them (copy attached – attachment #4)

A: There is a lot of stuff on Internet, e.g., Orange County, Florida has put all their documents on the web and we are looking at all that and it is being reviewed.

Q: Nursing homes, elderly care settings have concerns about their role, if any. What is being done for training and education of these care providers? Several professional organizations related to these facilities have concerns, and may be letting them know would be a solution to this problem.

A: We have a senior aid group who are preparing to go to these facilities to provide information.

Comment: Some guidance is required for these nursing homes and elder care facilities.

Q: How does rapid response fit into this?

A: This falls under MEMA, but the Commissioner for Health also has independent power to mandate certain controls and order evacuation. The City falls under the State, DHMH and we follow their goals and objectives.

Pat Tate, Emergency Management Plan for UM, B (see Pat Tate's slides, Attachment #5). Lots of emergencies on campus, but not chem/bio/radiation. The types of emergencies and the agency with campus responsibility are shown on slide #4. Public Safety is the first responder and will become incident commander for many of these emergencies. Operations and Maintenance takes care of many emergencies.

Emergency plan is a combination of existing public safety plans, environmental safety and operation maintenance plans. Student health deals with psychological issues. These plans have been modified in the context of events since September 11^{th} 2001.

Emergency Management Plan establishes an emergency management team and the incident command system as the response process with an emergency response center.

The Emergency Plan establishes training. Goal is to make the University accessible to staff and visitors, to minimize damage to facilities and disruption to university programs and assist community.

Comments: Team headed by Emergency Management Director, (see slide # 9) for team composition. We are prepared to deal with outside agencies in our training, including the FBI, State Police, MIEMSS, Health and Fire Department.

Campus shut down authority is the President or his delegate.

Q. Is incident commander on site?

A. Yes. It would be more complicated for that person with a chemical attack. The Incident Commander would vary with the emergency; typically the agency or campus that has primary responsibility would lead. Communication is maintained with the Emergency Management Team to determine when the emergency is over. The Emergency Operations Center is set up in Technology Room over Pearl Street Garage and alternate is Pine Street Police Station. Three levels of response. The response process to call for the emergency response team is 711 – (soon to change to 911) calls campus police. (see slide #16). Desktop training is underway and includes training in radio use, and training exercises are scheduled.

Q: Is your incident command model different from City agencies?

A: It is the same as the FEMA model. In case of fire, we do not have our own fire crew – Environmental Health Services (EHS) would be the primary responder with the Fire Chief who is there. They would contact the electronics shop to confirm what the fire alarm enunciator data means and to get access to elevators. Then they are lead to correct place. Incident Commander at UM, B fire would be the Fire Department.

Q: How do you prevent several different Incident Commanders from the University being involved?

A: If there were a problem, it would come back to the Emergency Management Team who would then contact us to make a determination of who is in charge. When you get into a combination of things, (e.g., chemical and fire and explosion) (see Attachment #1 slide 9 scenario), it becomes very difficult to know who is overall in charge. The incident commander does not have to be an expert in all the 6 stovepipes of information on campus; they just have to be a good manager.

Q: Is there an authority that determines the overall in charge?

A: Yes, the Emergency Management Team Director makes the designation of incident commander – either themselves or they designate another. If say 5 different incidents occurred in different parts of the campus, then there would be 5 different incident commanders with the Emergency Management Team Director being in overall charge.

Q: I am not sure how it is set up – do you use FEMA standards?

Comment: FEMA has first on site as the Incident Commander on site – most likely, fire person – as each new department arrives, the person in charge needs to make a decision as to when it is safe to call in other departments, e.g., when an explosion occurs, they are trained not to rush in. They use dosimeters to exclude dirty bombs, etc. The Incident Commander, e.g., Fire Chief excludes chemical/radiation HAZMAT – ultimately this information is referred to command and control, so that no one on-site agency is making all the decisions.

Q: Is this a new FEMA Model?

A: In the last year or so, this has been FEMA standard.

Comment: There may well be a change in leadership with serial events, e.g., chemical and explosion.

Dr. George Anderson, Navy Research Laboratory. I am going to cover chemical and biological sensors and provide points of contact (POC). (See George Anderson's slides as Attachment #6).

The PCAD is a surface acoustic wave detector and is very small (slide #3). It is sensitive and fast and available today. The IMS-PCADdetector joins two detectors to give the best of both technologies (slide #4). MIME detects chemical vapors – "electronic nose" (slide #5). Naval Research Lab has been involved in development of JCAD (slide #6) with BAE systems, based on surface acoustic wave technology to detect nerve agents, blister and blood agents.

The potential biological agents are listed in slide #7 with the CDC highest threat agents highlighted. This huge list identifies the need for these detector systems to increase their capabilities. The optical Bio-Aerosol Monitor data from a Joint Field Trial is shown in slide #8, highlights the value in UV-fluorescence measurements in particle detection. Biosensor detectors may be antibody based or the identifiers may use DNA identification. Slide 10, a first responder system identifies 6 threat agents within 15 min. (web site:alexeter.com). (Slide #11), RAPTOR POC George Anderson. Single button operation and requires 1 ml liquid sample, testing for four targets simultaneously (tape change).

It is expensive to run, but not the sensor you would use to run 200 samples at once. It can run up to 40 (negative) samples a day comfortably before changing coupons. The methodology is fluoroimmunoassay, and can do any test that an ELISA can do. The RAPTOR runs a 5-13 min test; the longer the time the more sensitive, it is very sensitive for toxins, but not as sensitive for spores.

Q: It needs liquid, so how long does it sit?

A: Typically, 2-7 min. total assay time is 5-13 min. The RAPTOR tests one sample at a time for 4 targets – The array based sensor (slide 13) can do six samples with six different analyte simultaneously; will be improved to 12 samples with 12 analytes or samples for 124 analytes.

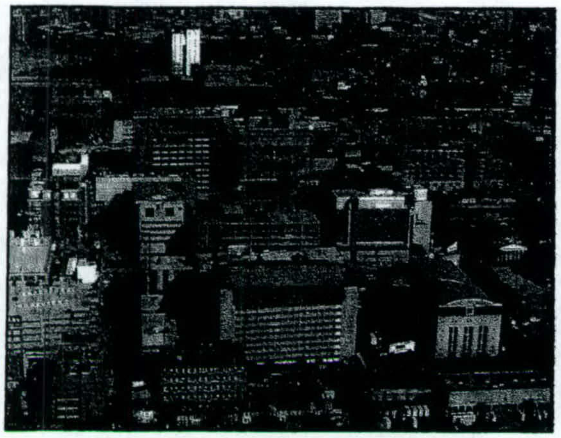
Q: What sort of problems have you been having coating optical probes with your antibodies?

A: We do not see significant problems with our assays. We are now transitioning the production of the assays to Research International, the manufacturer.

Q: Can you run clinical specimens?

A: Can run multiple specimens – blood plasma, urine, as long as no large particulates, e.g., topsoil unless filtered. Limitation of RAPTOR is that it is not ideal to run where all the samples are positive, as it gets expensive. Good for surveying an area – standard ELISA would be better for multiple simultaneous positive samples.

Colin Mackenzie thanked all the speakers for their excellent presentations and for those that participated in the meeting. He finished the meeting by confirming that minutes would be sent out. There will be a meeting in January 2003 to discuss local plans (table top type exercise) and if we have your e-mail, you will receive an invitation. He wished everyone a Happy Holiday.



PROBLEMS

1) Rapid Response Teams take too long to deploy
2) Real-time monitoring of Local Area Defense is inadequate
3) No civilian real-time detection and rapid response demonstration

Local Area Defense Demonstration (LADD)

Federal	State	City	Campus	Hospital	SOM	MIEMSS
Air Force	DHMH	Health Dept	Pres Office	CEO	Dean	Exec Dir
LtGenGP Taylor	*G.Benjamin*	*P.Beilenson*	*Pres.Ramsay*	*S.Schimpff*	*D.Wilson*	*R.Bass*
W.Beninati	J Casani	RVogel	M.Greenberger	D.Schrader	H.Dickler	R.Alcorta

SHOCK TRAUMA AIR FORCE MIEMSS CITY
Demonstration Community
UMMC SOM SON POISON CENTER

Real-time Local Area Chem/Rad Defense System for Military & Civilian Terrorist Targets

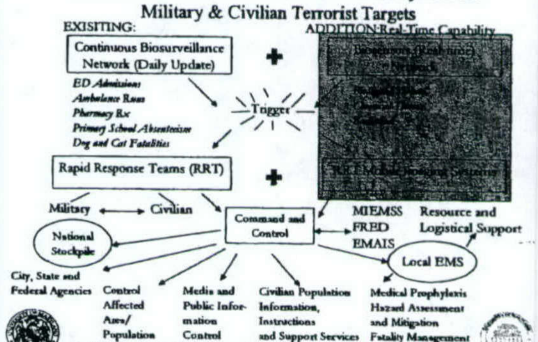


Fig 1 Addition of a Real-Time Sensor Network activates Rapid Response Team, who use Mobile Imaging System to provide real-time Incident Management for Command &Control

Local Area Defense Demonstration (LADD) (cont'd)

- Sensors—Bio/Chem/Radiation, Infectious Diseases, SOM
- Mobile Imaging/Video Network – National Study Center/Campus Police
- Rapid Response Team — Air Force/ MIEMSS/STC/EHS/MEO
- Command & Control --- City/MEMA
- Education--- Air Force
- Equipment—Air Force / Hospital
- Integration—MEMA/MIEMSS/City/ Hospital/National Study Center
- Biosurveillance Software— City

- SENSOR NETWORK – Bio/Chem/Radiation
- *Hospital--- MIEMSS—Shock Trauma = Highest intensity of Sensors*
- *Entrances--- Hospital/STC/MIEMSS*
- *Integrate with Campus Police surveillance*

Local Area Defense Demonstration (LADD)(cont'd)

- SCENARIO : Bomb Attack at MIEMSS knocks out SYSCOM then Chemical release at UMMS
- OBJECTIVES: Demonstrate capabilities e.g. RRTeam deployed in 10 min. Show resource acquisition e.g. 50 ventilators & 100 beds within one hour. Identify staffing skills and needs. Decontaminate 400 people.
- OUTCOME: Show how a local community can organize an immediate and coordinated response. Define performance targets. Develop strategies to cope with the psychological casualties and over-triage. Integrate with City & State & Federal Plans

AIMS

1) Demonstrate a real-time detection and rapid response system for local area defense on the UMB campus
2) Identify Rapid Response Team and community response capabilities when sensor system is triggered
3) Develop strategies to cope with the psychological casualty and evaluate mechanism for rapid treatment and tracking of casualties in need of emergency medical care

Post event: Overtriage & %Critical Mortality

	Overtriage	%Critical Mortality
Atlanta	42	0
Oklahoma	69	8
Israel	76	13
Paris	80	18
Birmingham	78	22
Bologna	73	23
Old Bailey	79	25
Buenos Aires	66	29
CuChi	75	33
Beirut	80	37

Historical Perspective October 23, 1983 Beirut Lebanon

- U.S. Marine Corps
- most powerful non-nuclear blast ever
- 12,000 lbs TNT
- 346 casualties
- 241 death (70%)

OUTCOMES

1) Demonstrate the capability of a terrorist-target local community to organize an immediate and coordinated defense response
2) Develop and test strategies to cope with psychological casualties while minimizing over triage and allowing tracking massive numbers of physically traumatized casualties.
3) Evaluate data provided by environmental sensors deployed in a civilian community

STATEWIDE RELEVANCE

1) Demonstrate collaboration between federal, state, city, local agencies in real-time terrorist defense response and casualty triage, treatment and control
2) Identify whether Rapid Response Teams can achieve landmarks of response, triage, treatment and control within time frames that would realistically save lives from chemical attack

STATEWIDE RELEVANCE

3) Test an electronic triage tag and psychological casualty control
4) Exercises will include triage management, resource access and casualty disposition and will provide data on utilizing of area hospital resource capability and mobilization of personnel, beds and emergency equipment
5) Demonstration project would be nearby to Fort Detrick, Aberdeen Proving Ground, and Washington, DC and will be a surrogate testbed for installation of such a system at military facilities and even at national sites which are terrorist targets

Albuquerque BDI Environmental Monitoring

"As a minimum, sample collection devices will include samplers previously implemented in other programs. Devices should include both (1) those collecting samples via dry filtration for subsequent analysis in an analytical laboratory, and (2) those providing near real-time reporting of status."

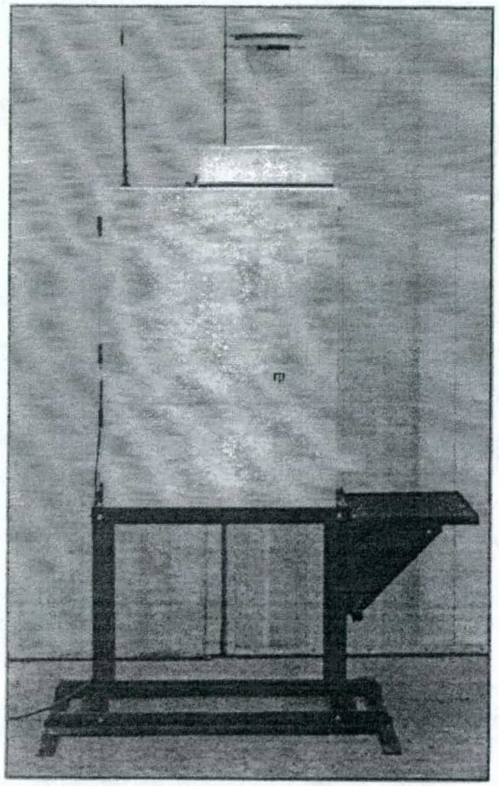
--NNSA Statement of Work

Objective: City-Wide Coverage for Routine Operations and Special Events

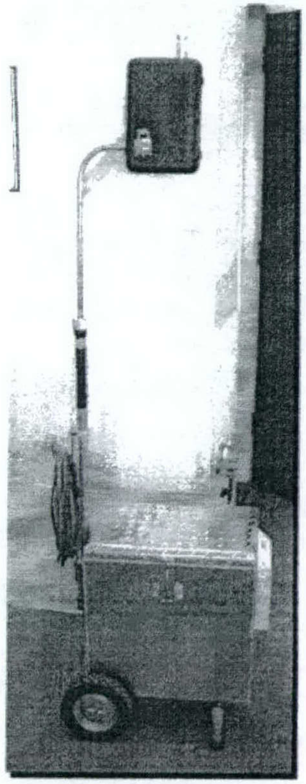
NNSA National Nuclear Security Administration

DTRA DEFENSE THREAT REDUCTION AGENCY

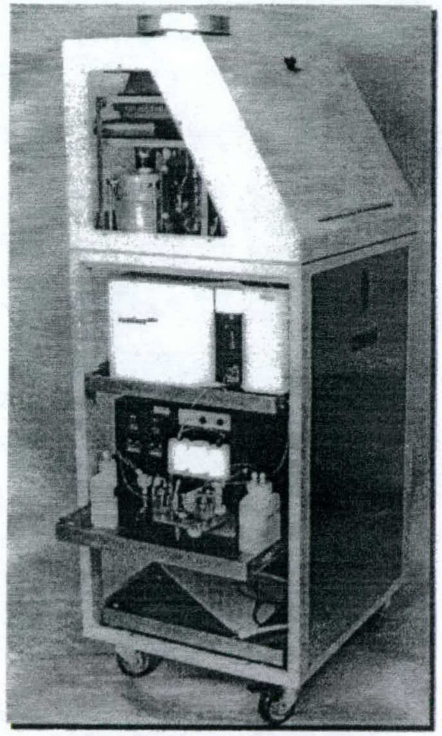
NNSA Environmental Monitoring Technologies



Distributed Sampling Unit (DSU)

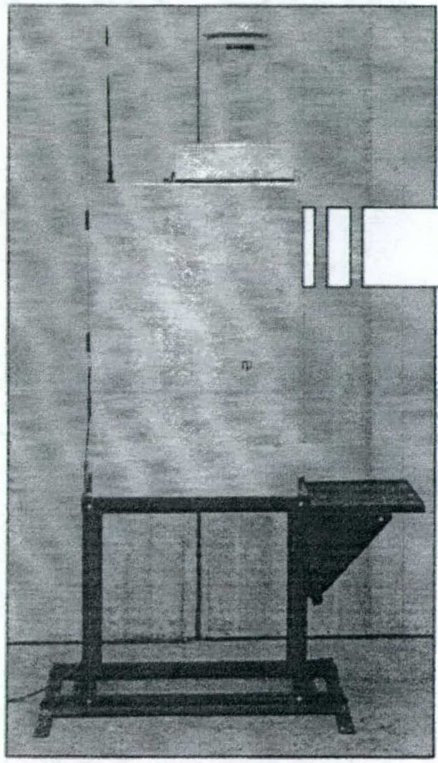


Portable Sampling Unit (PSU)

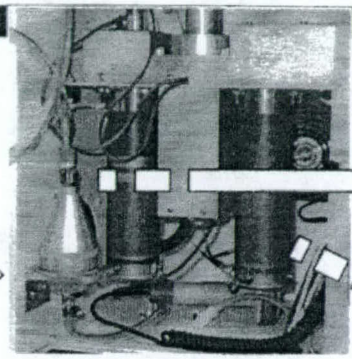


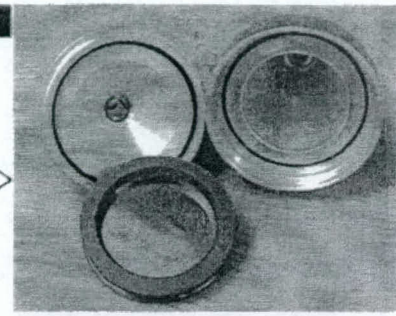
Autonomous Pathogen Detection System (APDS)

Distributed Sampling Unit (DSU)

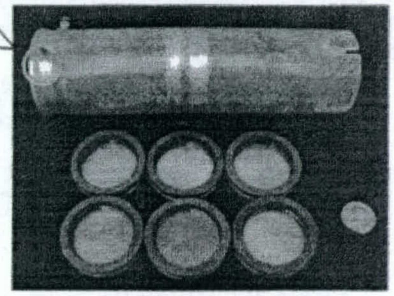


Distributed Sampling Unit (DSU)





Long-Exposure Filter

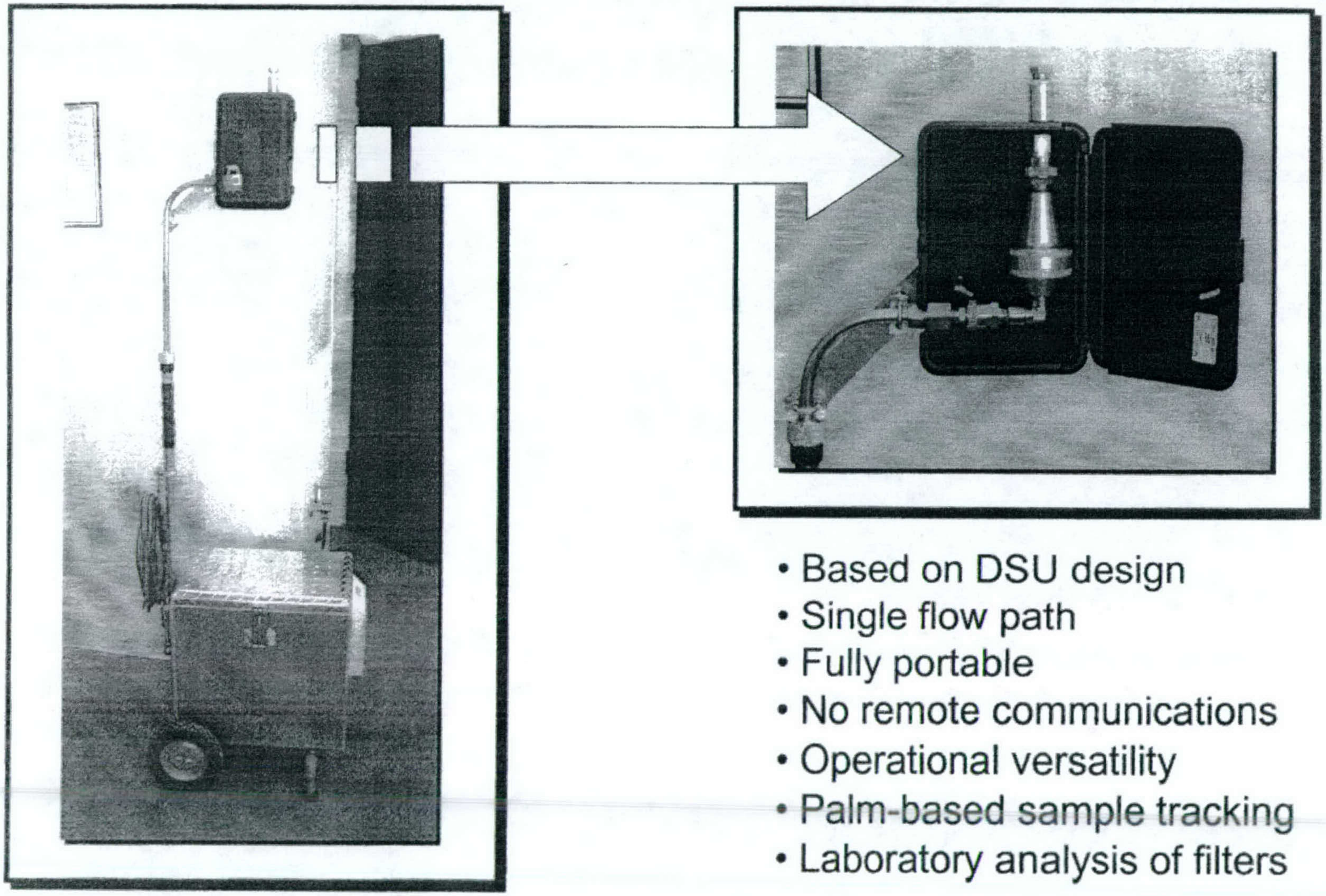


Short-Exposure Filter Magazine

- Distributed aerosol collector
- Live-agent & field deployment tested
- Self-configuring communications
- Remote status monitoring, start & stop
- Operational versatility
- Sample management system for sample tracking/ result reporting
- Laboratory analysis of filters
- Durable, weatherproof

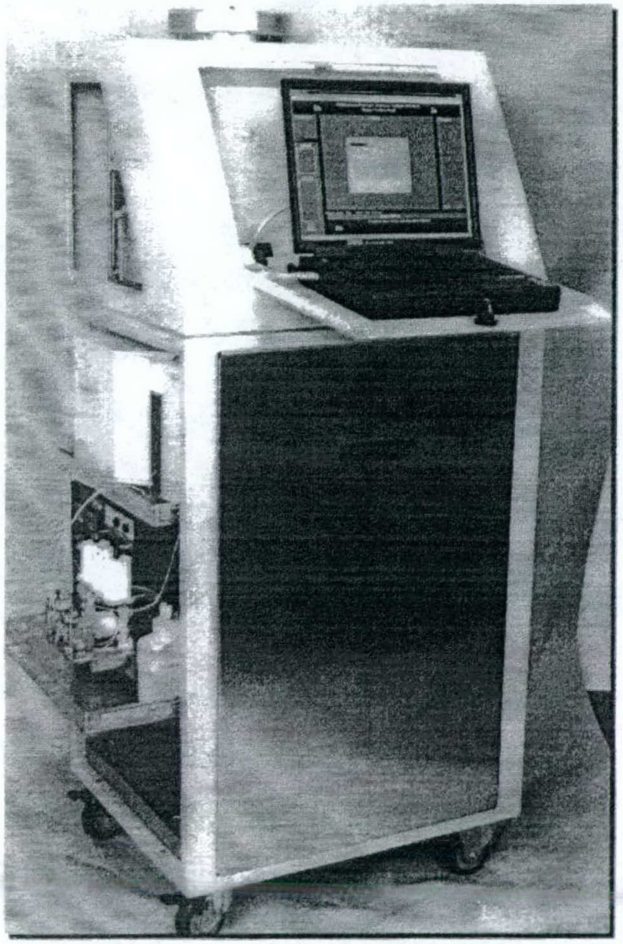
Deployed in Salt Lake City for the 2002 Winter Olympics

Portable Sampling Unit (PSU)



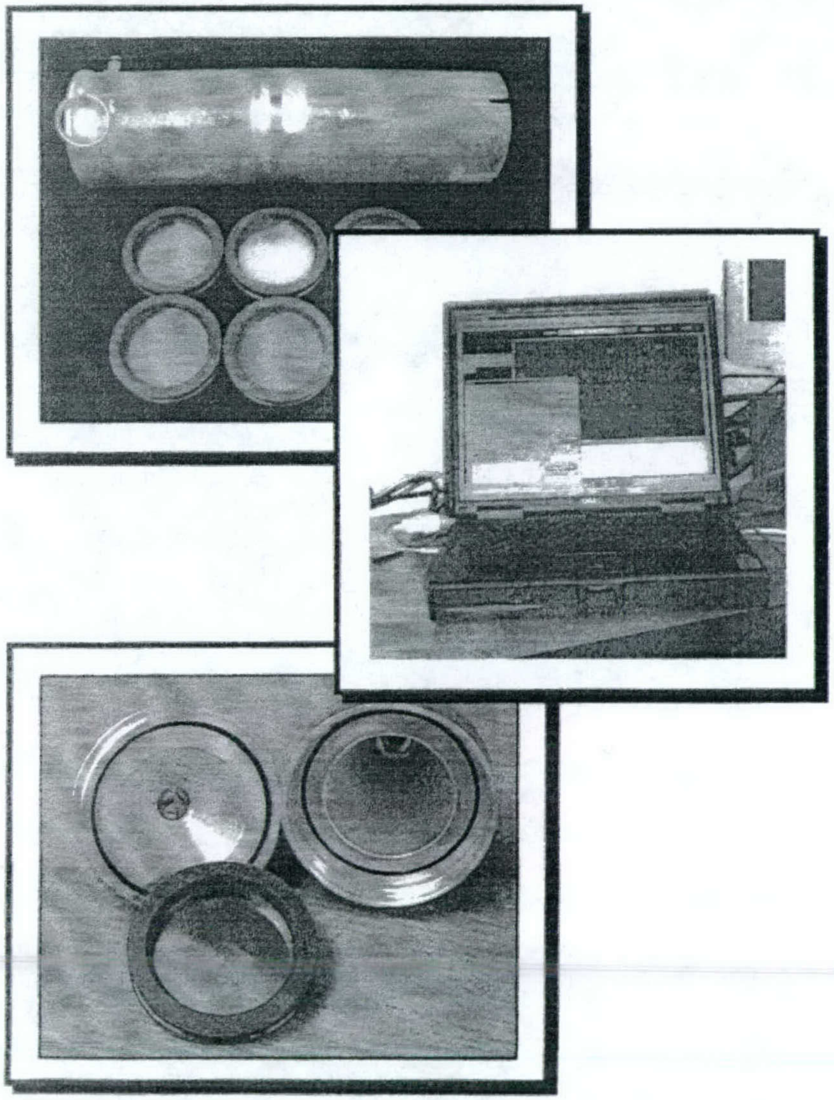
- Based on DSU design
- Single flow path
- Fully portable
- No remote communications
- Operational versatility
- Palm-based sample tracking
- Laboratory analysis of filters

Autonomous Pathogen Detection System (APDS)



- Standalone unit
- Continuous or on-demand immunoassay measurements of airborne biological agents
- Completely automated:
  - aerosol sampling
  - in-line sample preparation fluidics
  - multiplexed flow cytometer detection/identification assays
  - data processing and reporting units
- Wireless internet communications
- Remote status monitoring, start & stop
- Simulant tested
- Live agent testing scheduled for 9/02

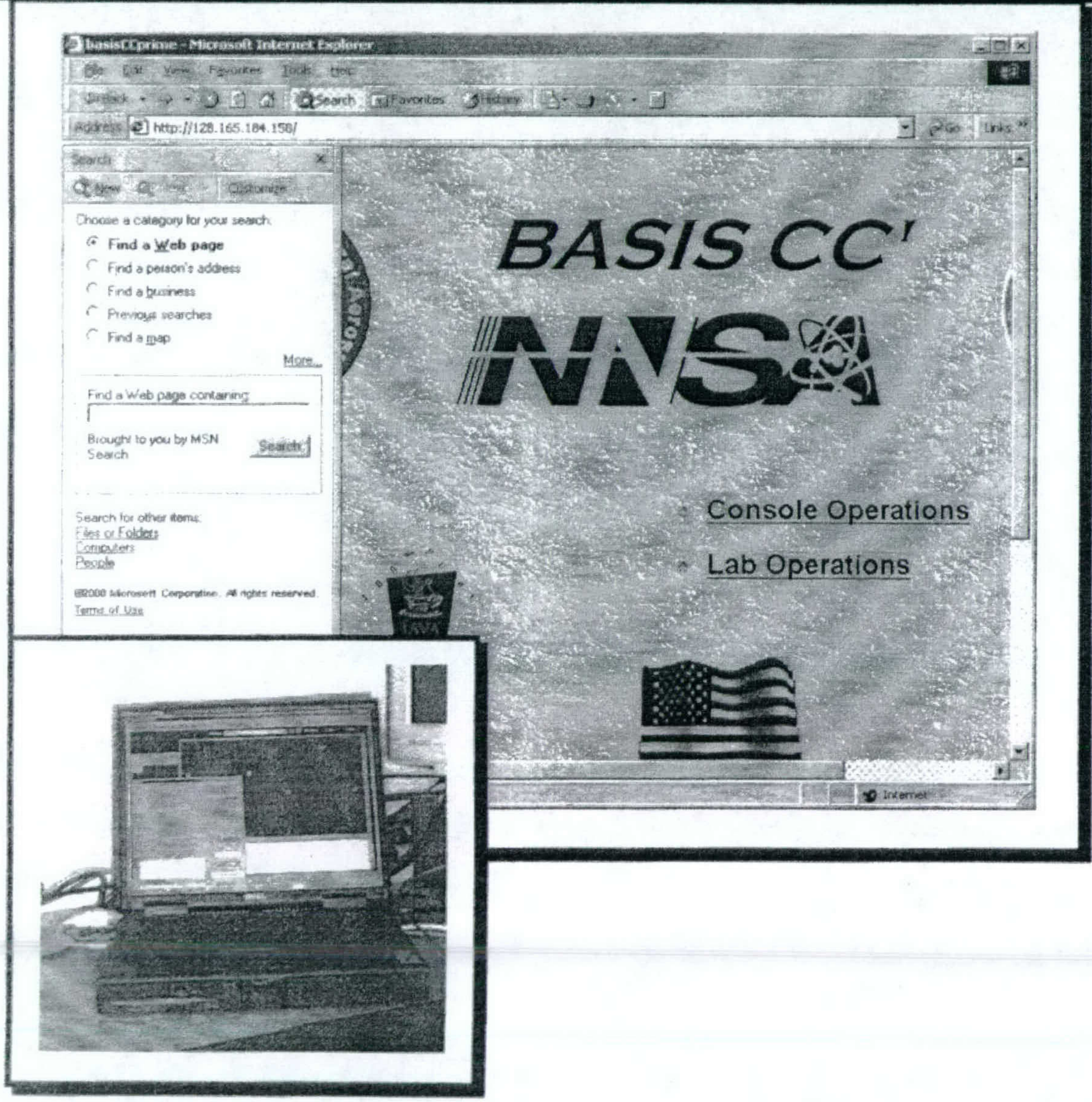
Sample Management System



Sample Management System (SMS)

- Bar-coded sample tracking system follows filters from creation to lab result
- User PIN numbers allow chain of custody tracking with time entry at
  - Creation
  - Dispatch
  - Insertion into collector
  - Removal from collector
  - Receiving
  - Transfer to Lab
- Automatic entry into sample tracking database
- Database archive allows easy information retrieval

Command, Control and Information Flow are Managed Remotely



Command Console Software (ComCon)

- Near-real-time remote monitoring of DSU, APDS
  - status and security information
  - automatically archived
- Remote start and stop
- Receives and stores information from SMS
- Automatic notification of system irregularities
  - e.g. reduced airflow, missing sample
- Master database repository
- Hot-swappable backup for system durability

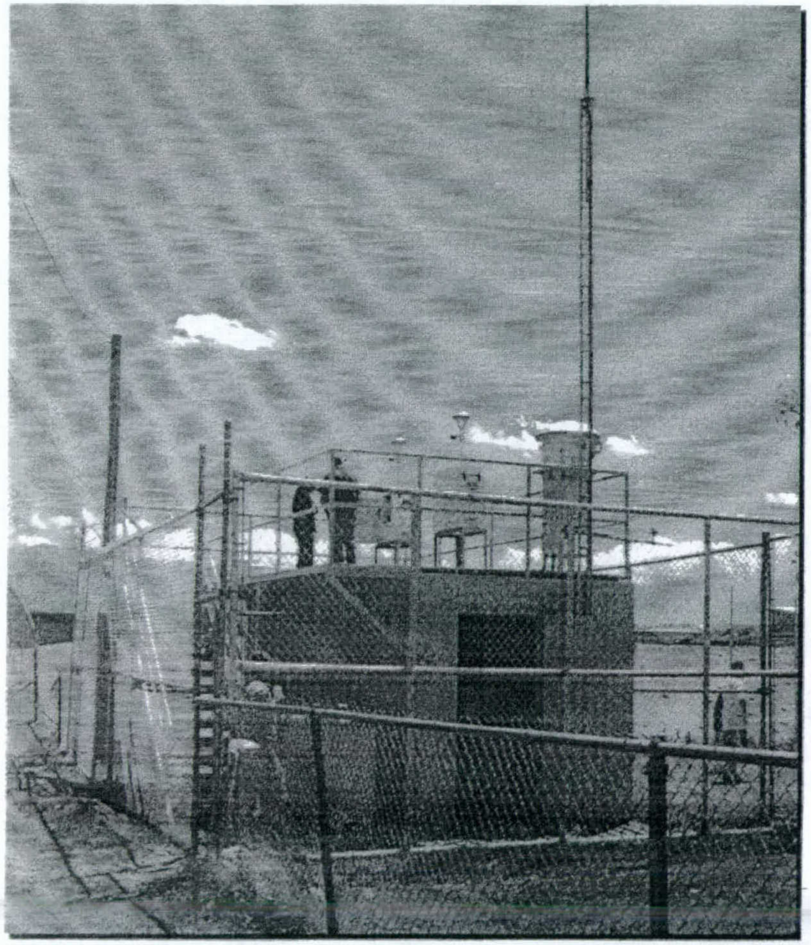
Interactions With Albuquerque

The Department of Environmental Health's Air Quality Division has jurisdiction over air monitoring and airflow modeling for the City, including all major facilities.

"Our mission is to serve the citizens of Albuquerque and Bernalillo County through programs designed to prevent disease and disability, promote health and protect the environment."

Discussions about siting and logistics (e.g. access, power) are currently underway. Placement of all EM units will be ultimately approved by the EHD.

Albuquerque BDI Site Selection Rationale



Existing City Air Quality Monitoring Stations

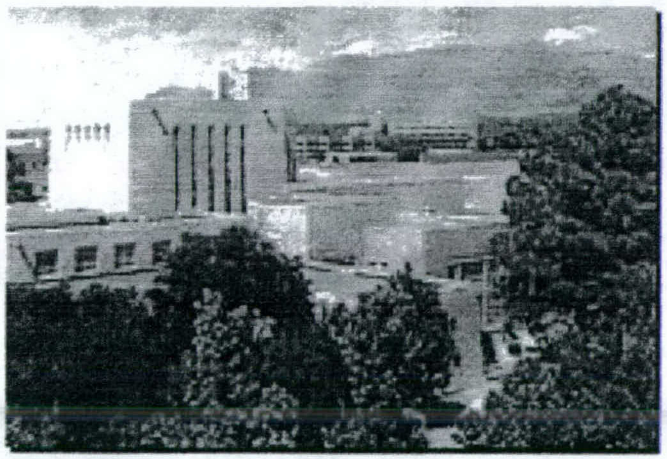
- Maintained by City of Albuquerque Environmental Health Department to monitor airborne particulates, VOCs, heavy metals
- Widespread coverage (10 locations in Albuquerque and Bernalillo county)
- Sites chosen based on local wind patterns
- Sites chosen based on local demographics
- Co-located meteorological data collection
- Particulate monitors at sites are the base model for the Distributed Sampling Units; alleviates concern about unfamiliar equipment in residential neighborhoods

Albuquerque BDI Site Selection Rationale

City/County Government Building

Key City Facilities & Gathering Places

- High-priority facilities
- High-throughput public places
- Placement to be determined using airflow analyses



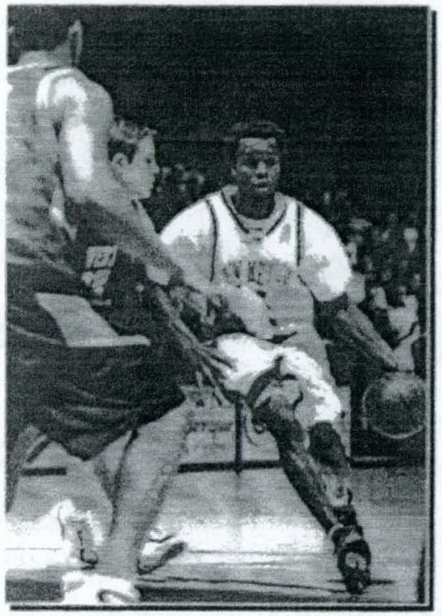
The University of New Mexico Campus

Winrock Mall

Albuquerque BDI Site Selection Rationale

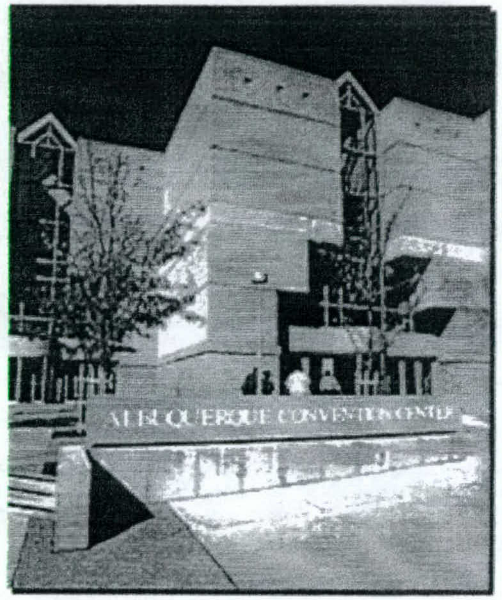
Special Event Locations

- High-profile, high-attendance special events
- Portable instrumentation (PSUs)
- Placement to be determined using airflow analyses



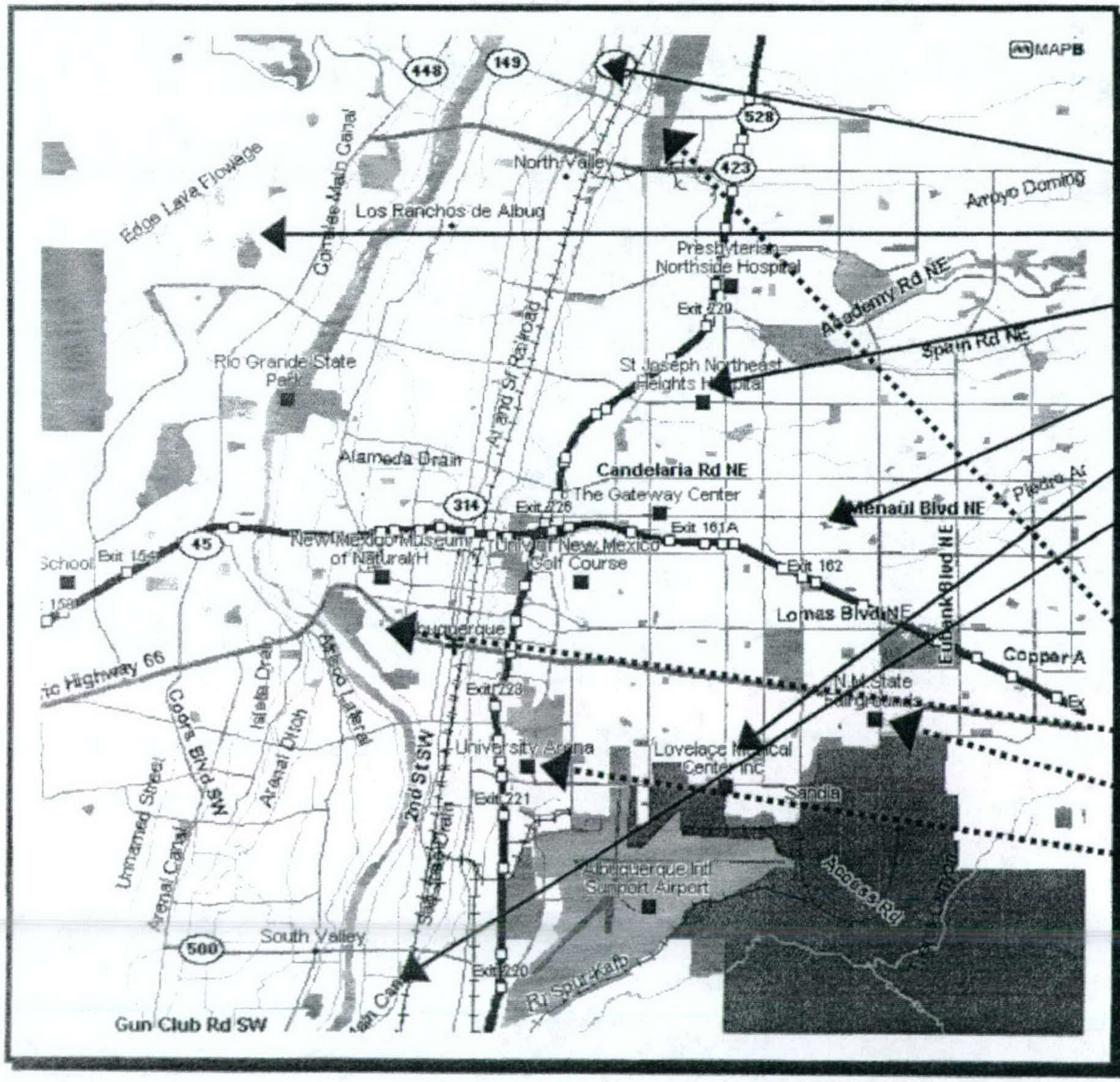
NCAA Mens' and Womens' Basketball begins 11/01 at The UNM Pit

Albuquerque International Balloon Fiesta October 5-13, 2002



Albuquerque Convention Center

NNSA Environmental Monitoring Sites



DSUs Co-Located with EHD Air Monitoring Sites

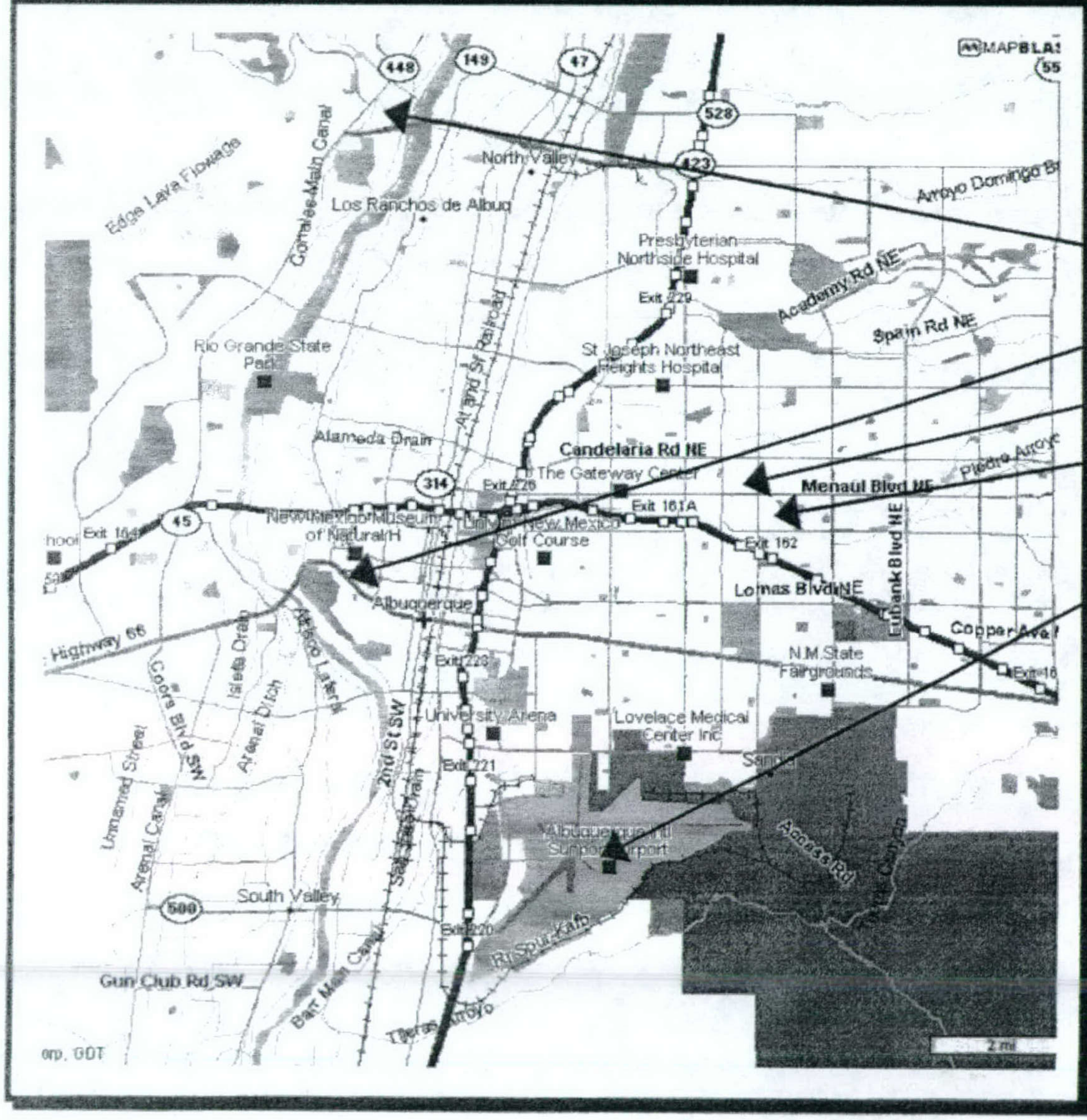
North Valley*
Taylor Ranch*
Del Norte*
Uptown Zuni Park
Southeast Heights
South Valley*

PSUs for Special Events

Balloon Fiesta*
Convention Center*
State Fair
The Pit (University Arena)

** Indicates priority site*

NNSA Environmental Monitoring Sites



DSUs/PSUs at Other Key City Facilities or Gathering Places

Cottonwood Mall (PSU, inside)

Civic Plaza (DSU, outside)*

Coronado Mall (PSU, inside)*

Winrock Mall (PSU, inside)

Airport*

APDS: 2 indoors

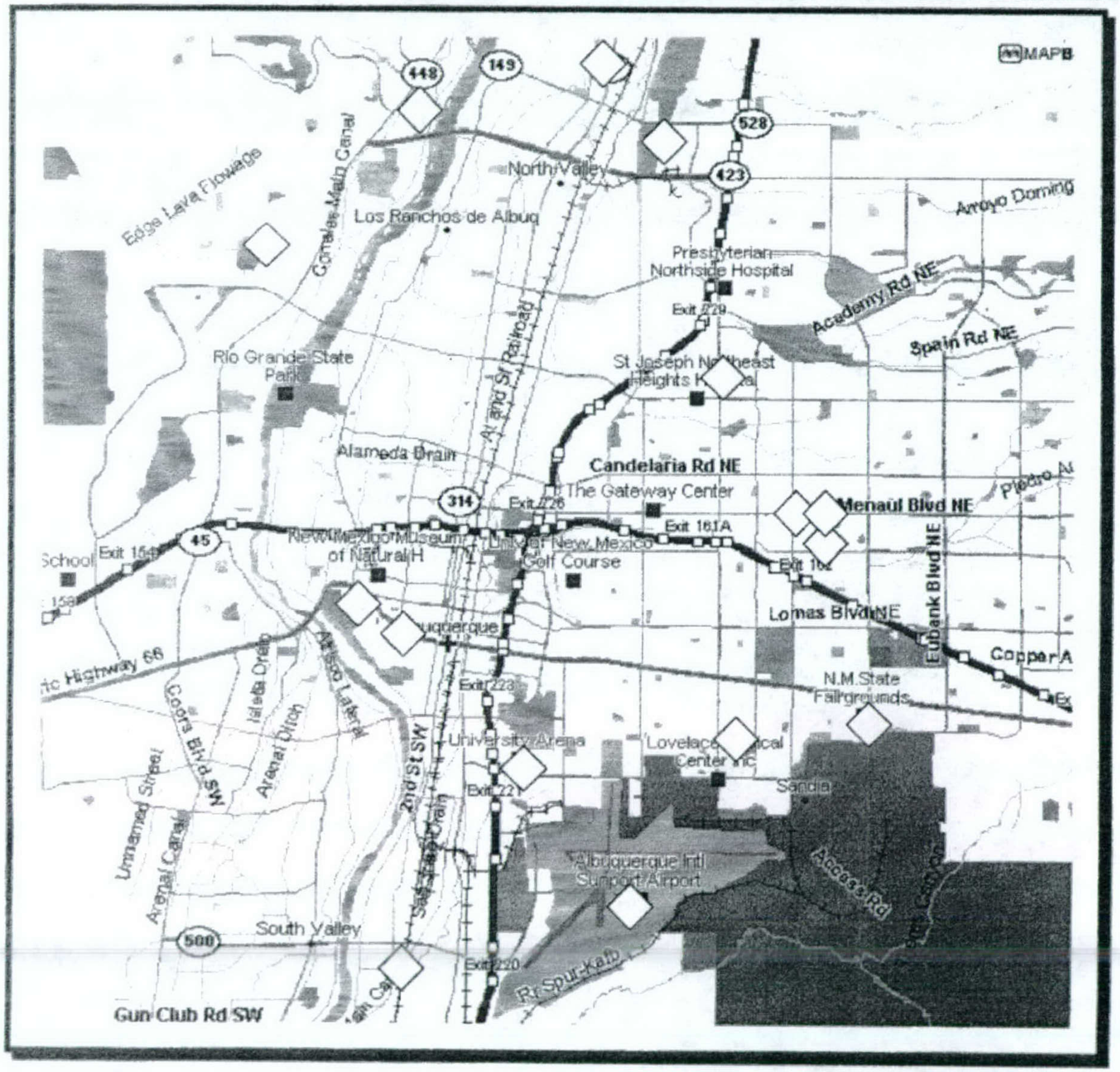
DSUs: 1 indoors, 1 outdoors

PSUs: 1 indoors

Other equipment TBD

* *Indicates priority site*

NNSA Environmental Monitoring Coverage



Objective: City-Wide Coverage for Routine Operations and Special Events

◇ DSUs Co-Located with EHD Air Monitoring Sites

◇ DSUs or PSUs at Other Key City Facilities or Gathering Places

◇ PSUs for Special Events

◇ Airport

1

Sensor Development at the US Naval Research Laboratory

George P. Anderson Ph.D.
Naval Research Laboratory
Center for Bio/Molecular Science and Engineering
Code 6900
Washington, DC 20375

2

Chemical Agents

What is the threat?

Nerve, Blister, Blood Agents
(small chemicals)

pCAD Chemical Agent Detector

Naval Research Laboratory
Washington, DC 20375 3

pCAD provides for the first time (w/polymer coated SAW sensors) true real-time agent detection capabilities with sub second equilibrated agent responses, robust performance in a dynamically humidity/temperature changing environment for ground and UAV applications, a palm sized system fabricated with commercial off the shelf components, and low power operation with no consumables.

Current Status:
- Palm sized Prototypes ready for surety testing and training
- Field testing capability
- Further optimization/ruggedization required

POC: R. Andrew McGill
Naval Research Laboratory
Code 6370,Washington DC 20375
Tel: (202) 767-0063; Fax (202) 767-5301
email: amcgill@ccf.nrl.navy.mil

Current or Projected System Capabilities:
- Chemical Agent Vapor Detection with low ppb limits
- T^{90} <0.1s for 95% Signal (100-1000 Faster Signal Kinetics)
- Rapid baseline restoration (2-4s)
- Eliminated Humidity and Transient Temperature issues
- High discrimination for diesel, gasoline etc
- System Power 0.5W Continuous (Reduction of 90%)
- Weight 0.5lb (Palm sized system)
- Zero warm up time for efficient intermittent operation
- Wireless Link
- Successful Preliminary Ground and UAV flight tests

IMS-SAW Chemical Agent Detector

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Washington, DC 20375 4

Existing NRLpCAD SAW Detector

Existing Graseby IMS Detector

ISCAD joins two different detectors together that utilize orthogonally based detection principles. Advanced IMS and SAW based detector technology that both offer true real-time signal kinetics are designed to be integrated into a single detector that utilizes data fusion to maximize the detector capabilities and minimize the risk of false alarm..

Current Status:
- Side-by-side testing of separate systems
- Training Data Collection
- Data Fusion Concepts In Development
- Integration Plan in Development

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email: amcgill@ccf.nrl.navy.mil

Current or Projected System Capabilities:
- Detection in real-time of a wide range of individual and complex mixtures of
Nerve, Blister, Blood Agents, and Precursors in the presence of interferents.
- Example Actual Demonstrated Detection Capabilities:
Real-time (0.1s): GD, HD, CK, CG
Detection complete in 0.25 second for 95% of signal
- Battery/AC operable.
- Field operational under broad range of conditions (T -20 to 50°C, RH 0-98%).

MIME Chemical Vapor Sensor

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Washington, DC 20375 5

The MIME (Metal-Insulator-Metal-Ensemble) chemi-resistor is a new development in solid-state chemical vapor sensors. This sensor may be scaled from the micron to the nanometer regime and integrates with planar silicon technology. An entire detection system may be packaged within the volume of a wristwatch.

Current Status:
- Commercialized as VaporLab by MSI/Sawtek
- Developmental work ongoing
- Scaling laws under investigation

POC: Arthur W. Snow
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Tel: (202) 767-4351; Fax (202) 767-0594
E-mail: snow@ccf.nrl.navy.mil

Current or Projected Capabilities:
- Electronic Nose Chemical Vapor Detection
- ppb Chemical Agent Simulant Detection
- Response and recovery times < 1 sec
- Nanoamp sensor current requirement
- Humidity interference negligible
- Facile total organic detection
- Nanometer scale sensor element
- Condensed phase operation

Joint Chemical Agent Detector

Naval Research Laboratory
Washington, DC 20375 6

JCAD

Introduction: NRL has been a major player in JCAD from its initial formation in 1995. NRL researchers participated in the early screening of potential sensor technologies suitable for the joint service users, assisted in developing the performance specifications for the JCAD sensor system, and worked with the Air Force JCAD Program Managers during the selection process for a technology and contractor to produce the hand held sensor system. In 1998, TRACOR (now, BAE) was selected to develop the JCAD sensor system based on the surface acoustic wave (SAW) sensor technology.

Current Status:
- Production Contract Award in FY02 (270,000 units)

POC: David L. Venezky
Naval Research Laboratory
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Tel: (202) 767-3550; Fax (202) 767-3321
E-mail: venezky@ccf.nrl.navy.mil

Current or Projected Capabilities:
- Hand held and no more than 2 pounds and 40 cu. in.
- Real-time detection of nerve agents (GD, GB, VX, GA, GF); blister agents (HD, HN, L); blood agents (AC, CK)
- Indicate point detection concentration levels
- Store up to 72 hours of detection data
- Suitable to be networked and remotely controlled as well as fully compatible with JWARN
- Operated by primary battery (24+ hrs.), rechargeable battery, DC and/or AC power
- Operating temperature: -32°C to +49°C

7

Biological Agents

What is the threat?

The Australia List of Threat Agents

Viruses
Chikungunya
Congo-Crimean Fever
Dengue
EEE
Ebola
Hantaan
JEE
Junin
Lassa fever
Lymphocytic choriomeningitis
Machupo
Marburg
Monkey pox
Rift Valley fever
Russian Spring-summer Enceph
Variola
VEE
WEE
White pox
Yellow fever

Rickettsiae
Rickettsia quintana
Coxiella burnetii (Q fever)
Rickettsia prowasecki (typhus)
Rickettsia rickettsii (RMSF)

Bacteria
B. anthracis
Brucella abortus
B. melitensis
B. suis
Burkholderia mallei
Burkholderia pseudomallei
Chlamydia psittaci
Clostridium botulinum
Francisella tularensis
Salmonella typhi (typhoid)
Shigella dysenteriae
V. cholerae
Y. pestis

Toxins
Botulinum toxin(s)
Clostridium perfringens toxin
Conotoxin
Microcystin
Ricin
Saxitoxin
Shiga toxin
Staph. aureus toxins (SEA, SEB, SEC...)
Tetrodotoxin
Verotoxin
Aflatoxin

*CDC defined these agents to be of highest concern, 2000

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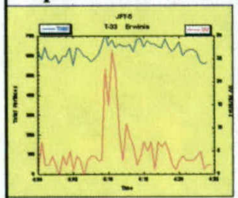
Optical Bio-Aerosol Monitor

Naval Research Laboratory
Washington, DC 20375



The current single particle fluorescence analyzer (SPFA) prototype counts and sizes all ambient aerosols and also interrogates each particle with a UV laser beam pulse. Induced fluorescence from the laser pulse is measured in two spectral bands to differentiate biological from non-biological particles. As depicted, the total (blue) and biological (red) aerosol concentrations can be acquired and displayed as a function of time. (The red peak at 4:10 signals the presence of a released bacteria, *Ewinia herbicola.*)

Current Status:
- Prototype bio-aerosol trigger device, SPFA, participated in outdoor tests: JFT-5 and JFT-6.
- Lab-evaluation of aerosol shape data
- Further optimization/ruggedization required

POC: J. D. Eversole,
Naval Research Laboratory
Code 5615, Washington DC 20375
Tel: (202) 767-9523; Fax (202) 404-8114
email: eversolel@nrl.navy.mil

Current or Projected Capabilities:
- Biological agent aerosol detection
- Demonstrated discrimination against non-biological background
- Highest demonstrated sensitivity (≈ 1 ACPLA)
- Good SNR for particles down to 1 μm diameter
- Rapid response (near real time)
- Reduced size and weight
- Additional optical signatures for improved false alarm rate
  - particle shape, refractive index
  - multiple LIF excitation wavelengths

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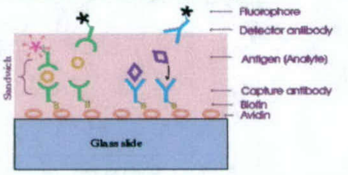
Biosensor

Required Capabilities

- Detection versus identification
  - Antibody based vs. DNA indentification
- Covert versus open operations
  - Automated, Portable, Speed, Multiagent capable
  - Continuous monitoring versus single use



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Guardian Reader

Alexeter Technologies LLC

Commercial Biological Defense Systems

Tetracore

Bio Threat Alert™ Test Strips from Tetracore currently available for order includes: ➤*Anthrax*, *Ricin*, *Bot Tox*
➤*SEB*, *Plague*, *Tularemia*

Toll Free (877) 591-5571 http://alexeter.com/

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RAPTOR Bio-Agent Detector

Naval Research Laboratory
Washington, DC 20375

The Rapid Automatic and Portable Fluorometer Assay System (RAPTOR™) is a portable device that can simultaneously monitor for up to four biological agents or toxins in a 1 ml liquid sample. The completely self-contained, programmable instrument integrates optics, fluidics, electronics, and software into one compact system for laboratroy and field assays.

Current Status:
- Commercialized by Research International

POC: George P. Anderson Ph.D.
Naval Research Laboratory
Center for Biomolecular Science & Engineering
Washington D.C. 20375
(202) 404-6033 • ganderson@cbmse.nrl.navy.mil

Current or Projected Capabilities:
- Single Button Operation
- Rapid detection (within minutes)
- Sensitivity (parts per billion)
- Able to detect up to 4 agents simultaneously
- Lightweight and compact for portability
- Capable of battery operation
- Disposable probes with long self-life
- Continuous Operation

➤Up to 40 negative assays on a single coupon
- Field Tested with 8 validated assays

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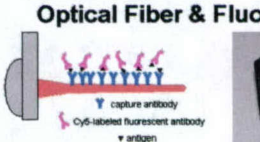
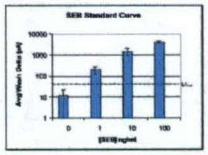
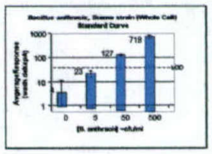
Optical Fiber & Fluoroimmunoassay



Evanescent Wave excitation facilitates surface sensitive detection





Array-based Biosensor

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Washington, DC 20375
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The species specificity of antibody/antigen binding combined with high sensitivity fluorescence imaging yields an ultrasensitive detection system. Detection limits are equivalent to the standard ELISA clinical assay system, but with results achieved within 15 minutes rather than 2 hours. Currently we can test 6 samples for 6 different analytes simultaneously.

Current Status:
- Sensitivity equivalent to ELISA method
- Prototype was field tested
- Fully automated system under development

POC: Frances S.Ligler
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Current or Projected Capabilities:

- bio-warfare agent detection
- toxin and explosive detection
- resistant to sample matrix effects - can detect in whole blood, river water, air sampler effluent
- very high sensitivity - ppb
- very high discrimination for targeted analyte
- automated sample and reagent delivery

Bead ARray Counter (BARC):
A Multi-Analyte DNA Biosensor on a Chip

Naval Research Laboratory
Washington, DC 20375
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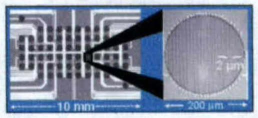

Introduction: BARC combines state-of-the-art magnetic materials with DNA-based biotechnology on a single sensor microchip. When DNA molecules from a biowarfare agent such as anthrax are present, miniature magnetic beads are captured onto the chip surface. These beads are counted by arrays of sensitive magnetic field sensors made of a special "giant magneto-resistive" alloy (the same type of material behind the rapid increase in computer hard-disk capacity). Because each sensor can detect a single magnetic bead, in theory, the BARC biosensor might ultimately detect a single molecule of DNA from a lethal agent.

Current Status:
- Benchtop prototype instrument built & tested
- BARC chips made by commercial vendor
- BARC patent licensed to startup company
- Further optimization/automation required

POC: Richard J. Colton
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E-mail: richard.colton@nrl.navy.mil

Current or Projected Capabilities:
- DNA chip for BW agent detection
- Demonstrated 3-analyte detection on 2nd generation chip
- Unoptimized sensitivity ~0.1 pM (~10^7 DNA copies/mL)
- DNA hybridization assays available for 8 BW agents (*Bacillus antracis* lethal factor, *Botulinum* neurotoxin A, *Botulinum* protective antigen, Vaccinia virus, *Botulinum* neurotoxin B, *Bacillus antracis* CapA, *Francisella tularensis*, and *Yersinia pestis)*
- 10 additional assays planned
- New 64-analyte BARC chip designed & fabricated (see picture above)
- Disposable assay/fluidics cartridge in final development

Cell-Based Biosensor

Naval Research Laboratory
Washington, DC 20375
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Cell-based biosensors provide physiologically-relevant responses to a wide range of known and unknown toxicants or agents. Unlike technologies that rely on structural recognition, cell-based biosensors respond only to compounds that are biologically active. The use of electrically active cells permit real-time monitoring of physiologic status. Changes in neural activity after agent exposure correlate with neurobehavioral effects.

Electrically active cells are cultured on thin film microelectrode arrays, where extracellular potentials can be monitored. Changes in the pattern of spontaneous activity across the microelectrode array are predictive of acute neurotoxicity of an agent. The portable instrument under development moves this technology, formerly limited to a laboratory, to outdoor environments.

Current Status:
- Portable device capable of 3-5 hrs of operation.
- Demonstrated with limited # of toxins
- Further/ruggedization required
- Prototype system for Naval Health Research Center/Tox Detachment.

POC: Joseph J. Pancrazio, PhD
Naval Research Laboratory
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Current or Projected Capabilities:
- **Neuroactive chemical/toxin agent** detection.
- Potable water sampling capability for known and unknown threats
- Constructed from off-the-shelf components.
- Shipping capability of intact cell-sensor elements.
- Interest in system deployment to other DoD laboratories
- With library of response profiles, agent classification possible.

Bio-Toxicity GenoSensor

Naval Research Laboratory
Washington, DC 20375
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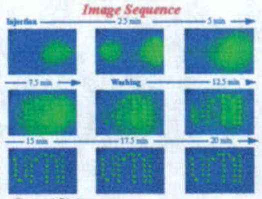
Image Sequence



We have developed a Genosenor system specifically to meet the needs of transcriptional level environmental toxicity assessment. The genosensor is based on highly regular microchannel glass wafers to which gene probes are covalently bound at discrete, addressable locations. The flow-through design enables hybridization and washing times, to be reduced from approximately 18 hours to 20 minutes. The genosensor is configured so that DNA from 28 environmental samples can be simultaneously hybridized with up to 64 different gene probes each.

Current Status:
- Simultaneous 28 sample capacity
- 20 minutes to full development
- 64 different gene probes/sample
- 200 µm diameter probe spot
- 250 µm pitch

POC: Ronald J. Tonucci
Naval Research Laboratory-MS&T
Code 6370, Washington, DC 20375
Tel: (202) 404-2101; Fax: 767-5301
email: tonucci@ccs.nrl.navy.mil

Current or Projected System Capabilities:
- Minimization of non-specific hybridization
- Simultaneous sample analysis.
- High sample throughput (>350 sample/hr) with standard data capture automated array readers and microscopic slide format.
- Newly developed nucleic acid hybridization probe software.
- > 100 samples analyzed per chip, simultaneously
- > 256 different gene probes/sample.

UAV Payload Platforms

Naval Research Laboratory
Washington, DC 20375
17

FINDER
Flight-Inserted Detection Expendable for Reconnaissance (Post-strike CWA Point Detector)

Extender
Air-Drop Deployable UAV

SENDER
Self Navigating Drone Expendable/Recoverable

Dragon Eye
Airborne Sensor System for Small Units

MAV
Micro UAV

Today a separate class of vehicles is evolving. Those being the lightweight, low cost, expendables. The NRL focus is affordable, and if necessary, expendable UAVs. These systems are designed not to MILSPECs, but to the best commercial practices for the commercial aviation industry and specifically for expendability in production.

POC: Al Cross
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Tel: (202) 767-4474
E-mail: across@ccs.nrl.navy.mil

Current NRL UAV Characteristics:

	MITE 2	Dragon Eye	SENDER	Extender	FINDER
Wingspan (ft)	1.18	2.4	4.0	10.2	8.9
Gross Wt (lb)	0.34	4.0	10	31	58
Payload Wt (lb)	0.05	1.0	1.0	7.0	13.5
Airspeed (kt)	20	40	44	40	70
Endurance (hr)	0.3	0.5	3.0	2.3	10.2
Link Range (km)	2	10	20	32	55
Wind Limit (kt)	5.0	20.0	23.0	none	none
Fuel	electric	electric	electric	electric/IF	Av Gas
Container (in)	3 x 14 x 14	5 x 5 x 29	8 x 22 x 22	10 x 30 x 30	12 x 24 x 66

DEFENSE THREAT REDUCTION AGENCY

DTRA

Making the World Safer

The Biological Defense Initiative

Environmental & Access Control Point Monitoring

Mr. Robert A. Kehlet, Program Mgr.
Mr. Ron Yoho, Deputy Program Mgr.
Mr. Larry Pollack, Monitoring Technology Mgr.
DTRA Technology Directorate

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Part of an integrated national plan for biological defense

- Monitoring -- Environmental/Access Control Point -- complementary with Medical Surveillance, to provide early warning that a biological attack or incident may have occurred
  - Apply to urban areas, other high-value assets, and special events
  - Reduce casualties
  - Minimize disruption to infrastructures
  - Support additional consequence management efforts
  - Ease public concerns regarding lack of preparedness
  - Deter against bioterrorism by reducing the apparent vulnerability

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DTRA

Making the World Safer

Timeline for BDI Project

- Equipment delivered and assembled throughout Sep 2002
- Testbed on-line and operating in Oct 2002
- Two Urban Prototype systems in place and operating by Jun 2004

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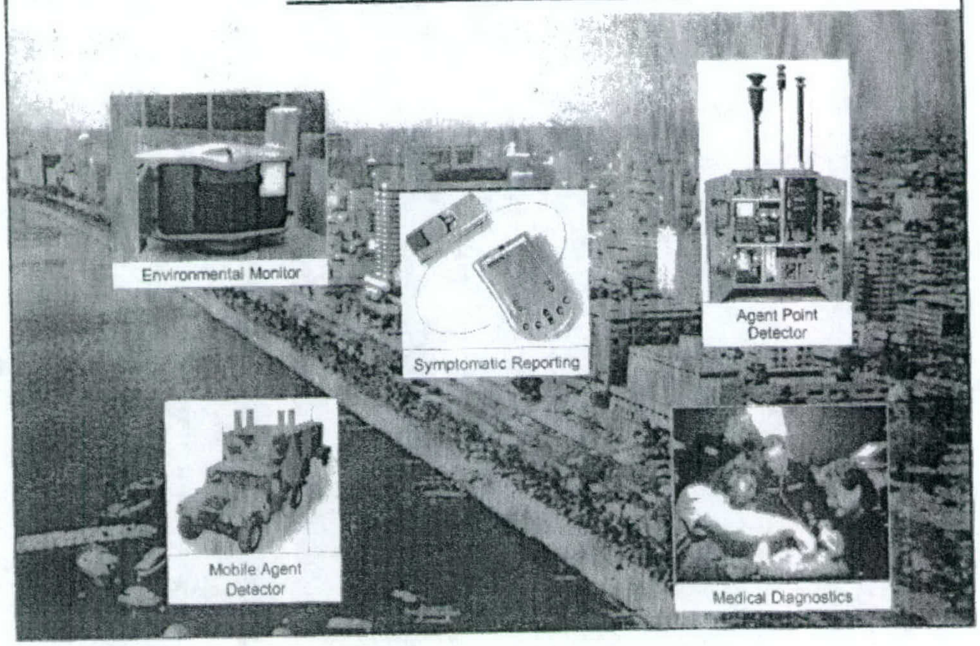
DTRA Making the World Safer

Our solution uses a layered approach to biological attack detection



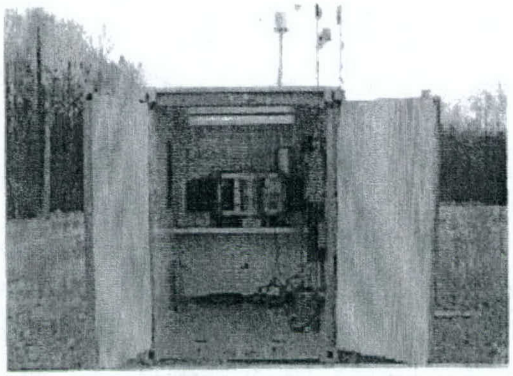
Objectives for the Testbed Environmental/ Access Control Point Monitoring

- Demonstrate that the various sensor systems can be integrated into the Operations Center
- Collect background data using the various sensor types
- Test the sensors with BW agent simulants / interferants to be introduced manually into the detector OR via a "planned data trigger"

Deployment of monitoring technology consists of three phases

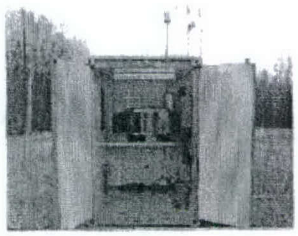
- Testbed centered in Albuquerque will have six monitoring system types active for October 2002 initial demonstration
  - Portal Shield biological monitoring system (5 sensors)
  - RAPID biological detection and identification (4 units)
  - BASIS Distributed Sampling Units (6 units and support equipment)
  - S3I, LLC bioparticulate monitoring system (1 unit w/10 sampling ports)
  - Dry Filtration Units (10 units) linked to command center by RDR network
  - Autonomous Pathogen Detection System-APDS (1 system)
- Testbed operation throughout BDI program duration will allow for testing of newly developed sensor technologies
- Sensor technologies successfully demonstrated through the testbed will be used to design and construct two Urban Prototype systems

Portal Shield



Five detector units will be deployed at the testbed

Portal Shield



- System consists of:
  - Aerosol particle detector/trigger
  - Wet cyclone particle collector
  - Mark III automated biological detector configured for eight BW agent organisms
  - Meteorological instruments
  - Control computer and radio transceiver
  - Tricon equipment cabinet with power management and environmental control systems
  - Command post computer with control and detect software

Portal Shield

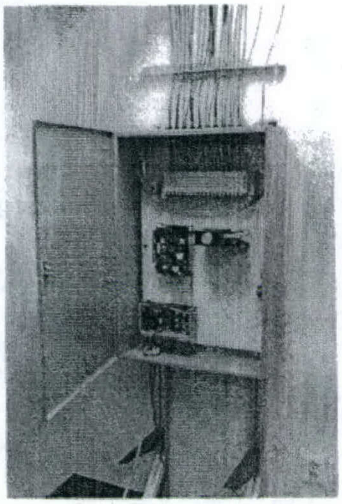
- System employs a multilevel approach to detection of biological agents:
  - Aerosol particle detector/trigger provides indication that particle counts in the target size range have increased above background
  - Trigger initiates the wet cyclone particle collector, which collects a particulate sample in a liquid buffer solution
  - The buffer solution is then applied to an immunoassay "ticket", which contains antibodies to detect eight BW agent organisms. The remainder of the liquid sample is archived for later retrieval by the sampling team
  - Once the ticket has developed (~5 minutes), a laser scanner reads the ticket and indicates which of the eight agents were detected
  - The results are relayed to the command computer, which employs an algorithm incorporating meteorological data to determine if two downwind detectors registered a positive detect
  - A "positive detect" triggers an alarm at the command center

S3I Bioparticulate Counter/Detector

- COTS detector unit with 10 port concentrator/collection manifold will be deployed at the testbed
- System excludes particulates larger than 20 μm
- Particles are irradiated with a laser beam
- The resulting scattering of the laser light provides particle size classification based on Mie scattering
- Fluorescence of biological particles created by the laser irradiation is measured by two channels of UV detectors at 266 and 400 nm wavelengths
- The fluorescence detected is used to create a ratio between the two wavelengths
- The ratio can be used to discriminate between various types of BW agent organisms

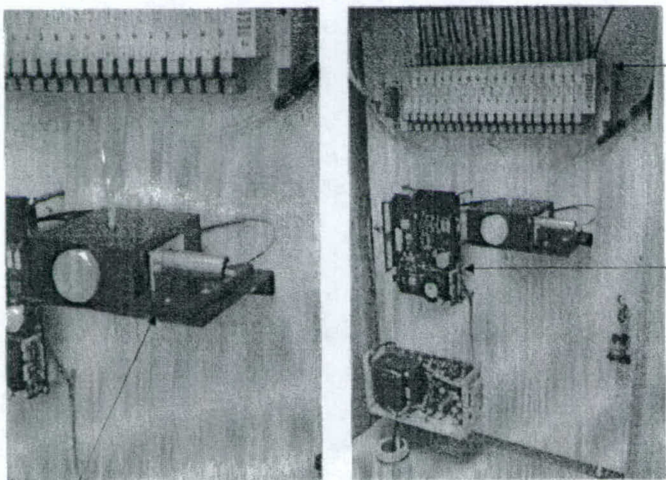
S3I-710 Bioaerosol Manifold

- Single manifold samples up to 20 locations
- Manifold networked with other manifolds & central monitoring station
- Manifold provides means for both aerosol collection & detection



NOTE: Slide courtesy of S3I

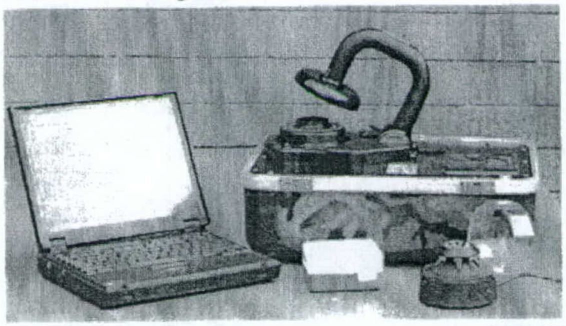
S3I-710 Bioaerosol Manifold



NOTE: Slide courtesy of S3I

RAPID PCR

- Provides on-site quick PCR analysis of suspected biological agents
- Used by mobile response teams to verify BW agent identity
- COTS with substantial performance data



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BASIS

- Configured for "detect-to treat" mission for effective and timely medical response
- Open architecture with flexibility to incorporate new technologies
- System architecture includes:
  - Distributed Sampling Units (DSUs): continuously collect aerosol samples in and around sites
  - Sample Management System(SMS): periodical sample retrieval, transportation, sample excision, and sample archiving
  - Relocatable Field Laboratory (RFL): DNA analyzed through PCR techniques validated through multi-agency process
  - Command Console (ComCon): on-line data management, planning/decision aids, consequence projection tools

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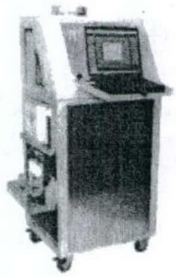
Autonomous Pathogen Detection System (APDS)



- Configured as a compact, autonomously operating biodetector for continuous monitoring of air samples and automatic reporting for fixed locations: a bio "smoke detector"
- System architecture includes:
  - Compact Flow Cytometer
  - PCR
  - Autonomous sample collection, sample preparation, and fluidics
- Simultaneous detection and identification of multiple biological warfare agents (pathogens and toxins)
- Fully autonomous operation for up to 24 hours

Dry Filtration Units (DFUs)

- Ten DFU units will be deployed at the testbed
- Collects particulates on filter media for later retrieval and subsequent laboratory analysis
- Units can be controlled using the RDR (Remote Data Relay) for on/off control
- Filter holder can accommodate two filters to provide a duplicity for archiving
- DFUs will be used to collect confirmatory samples when other detectors indicate the possible presence of a BW agent

NOTE: Slide courtesy of PEO CBD

The Environmental and Access Control Point Monitoring Working Group

The working group provides technical expertise to BDI and consists of members from the following organizations

- EPA
- USGS
- DARPA
- SBCCOM
- Los Alamos National Laboratory
- Oak Ridge National Laboratory
- Lawrence Livermore National Laboratory
- Sandia National Laboratories
- Idaho National Engineering and Environmental Laboratory
- DOT Volpe Center
- MIT Lincoln Labs

Partnering Opportunities with EPA

- Access to extensive particulate monitoring network in place in many urban areas
- Assistance with coordination of state and local authorities

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Partnering Opportunities with USGS

- Access to extensive network of satellite-linked streamflow gauge stations (appr. 3000 stations nationwide)
- Experience with data fusion and graphical display techniques
- Extensive GIS mapping network

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DTRA Making the World Safer

Major Milestones/Technical Challenges

- Systems Integration coordination to ensure successful data connectivity between individual sensors and operations center
- Selection of sampling locations for both access control point applications and broad area environmental monitoring to provide effective coverage
- Identifying and ameliorating false-positive triggers

November 12, 2002

November 12, 2002

Bio Defensive/Surveillance/Basic Science Initiatives

Meeting Date: November 12, 2002

Place: National Study Center for Trauma and EMS (NSC)
701 W. Pratt Street, Room 531
(410) 328-5085)

Agenda

10:00 a.m. Introduction of representatives from Baltimore City, Maryland EMS, State, Aberdeen Proving Ground, Ft. Detrick, Ft. Meade, National Guard, Walter Reed, Air Force at Shock Trauma, University of Maryland, Johns Hopkins University and National Study Center for Trauma and EMS (NSC).

NIH Initiative

Jim Campbell, MD Vaccine Research Center,
University of Maryland, Baltimore

Bio Defensive Initiative

Colin Mackenzie, MD, Professor and Director, NSC

Rapid Response Teams

Edgewood, Aberdeen Proving Ground – LTC George Steiger
Maryland EMS, Rick Alcorta, MD
NSC Mobile Telecommunications – Yan Xiao, PhD
Air Force – LTC William Beninati
Ft. Meade – Linda Whitby, MD

Discussion on planned collaborations

12 Noon Adjourn

Directions:

From I 95, take MLK Blvd. Exit
From MLK Blvd., take Pratt Street Exit
Park in garage in first block on left on Pratt Street
after exit from MLK Blvd.
Bring parking ticket for validation

NSC is opposite garage at 701 W. Pratt Street, 5th Floor.
Coffee and pastries will be provided.

Meeting on Homeland Security and Surveillance Initiatives
November 12, 2002
10:00 a.m. – 12 Noon

National Study Center for Trauma and EMS
701 W. Pratt Street
Baltimore, MD 21201

Participants

Baltimore City Health Department
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Center for Vaccine Development, University of Maryland
James Campbell, MD, University of Maryland, School of Medicine (jcampbell@medicine.umaryland.edu) for Mike Levine, Director (mlevine@medicine.umaryland.edu)
Emergency Medicine, Johns Hopkins School of Medicine
Gary Zimmer, MD (gzimmer1@jhml.edu)
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Johns Hopkins University, School of Public Health, Center for Immunization Research
David Taylor, MD (dtaylor@jhsph.edu) for Don Burke, Director
Maryland Institute for Emergency Medical Services Systems (MIEMSS)
Richard Alcorta, MD, Medical Director (ralcorta@MIEMSS.org)
Maryland National Guard
LTC James Grove, Military Support to Civilian Authorities Officer (james.grove@md.ngb.army.mil)
Linda Whitby, MD (lwhitby@sugicalmonitoring.net)
Maryland Poison Center
Bruce Anderson, MD, Director (banderso@rx.umaryland.edu)
National Study Center for Trauma and Emergency Medical System
Colin F. Mackenzie, MD, Director (cmack003@umaryland.edu)
Patricia C. Dischinger, PhD (pdischin@som.umaryland.edu)
Yan Xiao, PhD, (yxiao@umaryland.edu)
SBCCOM, Aberdeen Proving Ground
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LTC William Beninati, Chief, Rapid Response Systems (William.beninanti@pentagon.af.mil)
United States Army -- Fort Detrick
Claudia Oglivie (oglivie@tatrc.org)
Walter Reed Army Medical Center
Col. Ron Poropatich (ron.poropatich@amedd.army.mil)

First, Dr. Mackenzie welcomed representatives of the State, Baltimore City, Army, Air Force, Maryland National Guard, Johns Hopkins, University of Maryland and MIEMSS. The meeting started with participants introducing themselves (see cover page).

The purpose of the meeting was

1) To identify whether members of the group could assist the basic science NIH consortium of all medical schools in Virginia, West Virginia, DC, Maryland and part of Pennsylvania in their application and vice versa. In particular, the NIH application required an interface with the Rapid Response Team leaders of whom would present at this meeting.
2) To identify integration of civilian and military efforts for bio defense and consider how this more applied group of biodefense experts might coordinate their efforts in military and civilian locations around the State and Capitol Beltway locations.

Jim Campbell, MD, (representing Mike Levine, MD, Vaccine Research Center, UM,B, PI on NIH Consortium Grant Application.)

First, Dr. Campbell presented the NIH RFP (Attachment #1).

The NIH Consortium is separated into regions. The Mid Atlantic goes as far north as Delaware, includes MD, WV, VA, DC, and PA, composes 4 or 5 large programs of Research separated by people in different academic institutions across region in which the consortium is set up in these academic centers. One is a program geared toward anthrax, another towards tularemia and plague, a third toward pox viruses and a fourth on moving vaccine related research into the clinical arena. There are also bioinformatics, hemorrhagic fevers and enterics groups and a group to interface with rapid response teams.

James Campbell and Dave Taylor are looking at new technologies for trying to deliver vaccines in a mass campaign.

- NIH wants to fund about 4 consortiums now and 4-6 in subsequent years. The consortium is an attempt to coordinate lots of different efforts.

<u>Question</u>

Q: If it hasn't already been started on, are coordinating efforts progressing including cross border, civilian/military type arena in an emergency state?

A: Don Burke is talking with various states and with their government officials to see what is currently planned and then try to put together a regional plan.

A: Seamus Flynn, MD. State Licensure Board: There is an issue under discussion in Maryland about credentials in an acute event for currently inactive physicians out of practice (retired more than 5 years). BPQA are interested in coming to a solution on this that is equitable and across the board, and may be useful in emergencies.

Rick Alcorta, MD. With current emergency medical management systems, all 50 states are okay with utilizing resources in a regional manner. In a declared state of emergency, any state can request help from another state and can move across the border. Bringing a

consortium together of biomedical, bioterrorism, biologic and trauma specific experts is a huge effort.

David Taylor, MD. Hopkins research diagnostic component is headed by Rich Rothman in Emergency Medicine and Dave Kellam and a third group is more based on immunology looking at adverse responses to immunization.

NIH Grant itself in core part requests info and coordination about emergency response. Also NIH wants to know what their job is as compared to CDC and DHHS and others. NIH=developer of tools. CDC's job is biodefense for class A-C agents.

Rich Alcorta, MD. From emergency perspective in a biologic event, EMS is not a primary player. Because it is ongoing like second phase, third phase input and EMS personnel are going to be on the line. The questions are: How can we develop a response system to activate vaccination capability, mass vaccination, with an event that has mass fatality potential and requires significant inpatient capability?

Colin Mackenzie, MD. Discussed biological defense homeland security support program - one effort in the so-called biological defense initiative (BDI), which is a $240 million congressional appropriation. BDI has Objective of prototyping urban monitoring system with a timeline of June 2004 to have a potential model for national capability. The speculation is: there will be, 10 cities with Baltimore on list ($20 million each) and a testbed in Albuquerque, NM. Purpose is for biological protection capabilities, environmental monitoring using surveillance systems and looking for how we coordinate all these information sources into a plan of action that actually results in something happening. The speculation is that DTRA will pay cities to use their infrastructure. They will demonstrate the feasibility of integrating these different sources; will deliver info to decision makers and EM response personnel at local, state and national levels. BDI will build on the existing public health and safety infrastructure. Web site shows all this information (www.dtra.mil).

Strengths: Baltimore City has a Biosurveillance Network Internet based system. It has been up for a little over a year. DHMH-syndromic surveillance effort around capital beltway, Hospitals, universities collaborating on NIH effort, MIEMSS and Baltimore City EMS-tremendous strengths for Shock Trauma care team, airforce, other rapid response teams, NSC/Human Factors Research Mobile Imaging system.

- Strengths in the State of Maryland: Military-Aberdeen Proving Ground-Edgewood Rapid Response Team

- Fort Detrick-Combat Casualty-(Handout from last meeting)

- Fort Meade

- Maryland National Guard

- MIEMSS-FRED-Facilities Resource Emergency Database, EMAIS, and their Rapid Response Teams

An additional strength is that we are close to DC and agencies like NSA, Walter Reed other potential targets for terrorists attacks.

We could make a real-time demonstration that would trigger the rapid response team, if we had some biosensors that gave us identification of biological, chemical and radiation threat. With a mobile imaging system we could keep command and control (C&C) informed in real-time. FRED and EMAIS would update resources available to C&C to allow local EMS to initiate treatment, containment, etc. and C&C decide what resources to make use of.

- If we were to work together, we have all the elements right here, right now in this model for public buildings in the city or military bases in the state, where we could have something as a testbed.
- BDI is not looking for perfect solution but deploying something rapidly that does some of the job and is robust and practical. They are not looking for the complete, definitive answer. They are looking for others to help in different ways for the same BDI cause in other sites.

Questions to be answered: How would the rapid response team (RRT) respond to a chem-bio event in Baltimore city, in a military base, in Wash., DC? What resources could they deploy? How quickly? With whom could rapid response teams coordinate their activities? On the issue of borders, do the RRT's have authority in Washington and do RRT's have authority to function in military bases in MD? Has anyone got an inventory of RRT's in the area? Dr. Mackenzie's briefing slides are attached (Attachment #2)

LTC George Steiger. SBCCOM has First Responders with technical expert unit located in Aberdeen. Capabilities include biological instant response up to Incident Management response and Bio Rapid Response Team. SBCCOM has linkages into DOD chem-bio technical network. We provide chemical/biological technical support cell for them and have an information management mode where we can provide relevant chemical and biological information to task force commander. We are in direct support of the federal response to an incident (Tape ran out). LTC Steiger's briefing slides are attached (Attachment #3).

On the big picture depending on level of assets we have the ability for incident management through chemical/biological (CB) information network and our operations network. Very robust, deployable communications package brought to incident site. All depends on what is requested and what is approved as part of the federal response to a civil incident.

Questions and Answers

Q: What level of access for other health providers is there to the CB Information network, if any?

A: We operate with our aligned DOD technical partners to share info and right now just within military framework.

Q: What would it take to lift some of the restrictions, so that resource sharing could take place in a pre-event phase so that you can bring a city to some level of readiness?

A: Not many constraints on information sharing. What we have is chem and bio related. I don't think this is any reason why there can't be a link established in case something

occurs so that we can share info. In a pre-incident scenario I am not sure of and cannot speak for anyone else. Our network allows us when there is a particular incident to be in contact with our technical expert who has the bio expert there, so if we are supporting someone, they are our reach back source for technical info for the bio arena.

Q: I would think if you were looking to develop this kind of expertise in the state that Aberdeen could be very helpful in the training phase by providing you info and showing you how they've thought about it, etc. to develop those resources.

A: We have a homeland defense business unit that is part of the post biologic chemical command and they were heavily involved in the training of responders.

LTC James Grove, Maryland National Guard (NG).

A: There are some limitations so they are trying to push federal legislature to improve civil support team (CST).

CST's were assigned to the states, but not all states have them. Originally to provide support to the whole US with some cooperative agreements to work across states. But issues still need to be resolved because NG didn't belong to governor, but certainly has potential for assistance. CST's may get federalized and then can be brought to Maryland from another state. How mechanics will work is the subject of a lot of political discussion going on. The CST's are an asset that are out there and the states that do have them will be responsive within those states and on ground quickly. Federally we have additional hoops to go through to go across state borders, but depending on sensitivity or type, that approval can come quickly even with a phone call. (See LTC James Grove's MD National Guard Briefing, Attachment #4).

James "Seamus" FLYNN, MD. Brig. Gen. George Alexander from the MD Army National Guard has a full time job in the White House under Tom Ridge; he could be a possible resource we haven't explored yet.

Rick Alcorta, MD. MIEMSS is a combination of multiple integrated systems with the base being local jurisdictional responsibility and control. Incident command is based at MIEMSS to address the issue of how do we get the local jurisdiction both information, personnel and resources. A small group responds and others provide an information conduit for the incident commander logistic section to MEMA or MIEMSS, realizing that the most challenging and frequent breakdown is info exchange. How do we improve that process? MIEMSS has a daily response profile-the emergency management resource center (EMRC) and their systems communications center. The EMRC is connected to everyone of ED's in the state of MD plus we are moving to digital so that not only does this network transmit voice but will transmit data too. The microwave network is controlled by us and no one else (secured) can get on. From a biological attack perspective it is not as useful. It is more an emergency response profile to let us see what beds are available, drug supplies, equipment, etc.

Systems Communication Center (SYSCOM) – controls 12 helicopter dispatch, 8 sections with helicopters operating 24/7, the other 4 are backup or trainers

Facilities Resource Emergency Database (FRED) is an information tool we are working on in MD- has a drawback -if the Internet infrastructure goes down; this tool will not be available. The key here is info mgmt and gathering in a timely fashion.

How do we convey information that we had a tunnel fire? With a single push of a button we can disseminate info broad based to all individuals on the system. FRED is also used to distribute large quantities of patients throughout the system and also used as a surveillance tool.

28 out of 47 hospitals are EMS MOU'd hospitals which means they are generating between 25 and 100 beds depending upon the volume and their MOU for the military for a national disaster medical system response.

- FRED is primarily a model designed for a military conflict. Again heavily trauma in orientation, not so much biologic, so we need to revamp the criteria so we can improve the ability to respond and identify a biologic attack.

- Next is information conveyance-we had the Anthrax release. 1st day 10 separate protocol developments. We need to be able to: 1) check reliability, 2) update rapidly from a uniform source 3) resource categories- What do you have and what are you willing to give up? Not everybody that has a resource is willing to give it up. Inventory those in a real-time fashion so that we can send it in a mutual aid within or out of the state.

- Surveillance tool not very good but potential is there. Constant running in the background of every health dept and in time potentially any health care facility and then report information to epidemiology at DHMH and the Biosurveillance Team. Both at local and state level will have a real time basis rather than paper and potential phone calls to follow-up on.

- Patient tracking in time of potential terrorism. Currently in agreement with VA, WV, Penn., Delaware a standardized triage tag. Currently it is not linked to FRED but the info tag has a way of subtracting the one available from hospital ED. Those patients will then be able to get to a designated facility and we will know who it was and where they went.

- Poison control is an integral part of the system. Should poison control also be a bio surveillance tool? They may be a point of contact from the public. This has been discussed nationally and locally, but not clear yet. I think it should because they are going to get calls from civilians.

- Current methods of surveillance: CHAT System (County Hospital Alert and Tracking System). Every ED can decide if it is being overrun, or on red alert, mini-disaster, structural damage, fire, water or electrical damage.

- DHMH, MIEMSS, NEMA are connected Health Departments are connected
  Emergency Depts. are connected
  911 Centers and Emergency Mgmt Agencies all have to have this running constantly

- In time we hope to have FRED linked to the 911 center based CAD systems so we know how many units are available at any one time. This probably won't happen for another 5-10 years because all the CAD systems are different in the state of MD.

- What their heavy equipment resources and/or personnel are. In disaster we had lots of personnel but not enough equipment necessarily.
- What equipment is available, e.g., ventilators?
- Monitor 24/7 psychiatric beds inpt capability
- Psych bed status will update every 4-8 hrs so that ED will keep tool up so they know where the pts are and where beds are to send pts.
- Send further updates as info is fed to MIEMSS back out to the system. Real-time decisions based on this information, because it is going to be filtered, looked at and validated
- Key thing is why? Its fast, its secure, its reliable info, has situational updates and there is some redundancy (several layers of this)
- FRED is a Tool not just designed for MD but regional with other states online like PA (designed in house-no third party to pay maintenance fees, etc). MIEMSS will make sure other states use the same process, no tweaking with it, so we can work cooperatively and share data (the major key).

Q: The idea is whether we can develop FRED as a system to create beds. If a disaster of significant proportion what would be the capability to clear beds?

A: Sure, I can tell you what we did on Sept. 11th. We essentially did an EMRC call around. We were doing it by spreadsheet, not by an Internet based tool. At first pass when we called around to see how many beds can you handle, we were looking at 1000's of victims (at least in our minds) and burns and whole inventory (Tape ran out). Dr. Alcorta's briefing slides are attached (Attachment #5).

LTC William Beninati, United States Air Force

Key points about the biodefense issue.

1) How airforce is organized medically for disaster response
2) A laundry list of teams that we built and those that can function for deployment and those available for training and for a rapid response team.
3) Actual physical assets we have in Baltimore

In terms of specific teams, there is an infectious disease team, which is a module that is meant to go into a larger hospital and focus on diagnosis and treatment of infectious disease. There is also a biological augmentation team (lab team designed for environmental surveillance and diagnosis). This specific team has had some controversy with technology called RAPID. It's a PCR based technique where you test a variety of samples. This is more of a chemical based team, but some of the principles in terms of surveillance and decontamination apply. We have radiologic version of that team. Conceptually, if the EMS people are tied up elsewhere, this is something with a small amount of training, hospital based personnel can use to set up ambulatory decontamination facility.

The next concept is a modular patient care hospital system that starts with what we call SPEAR team and goes up to 25-bed hospital. It starts out with a preventive and aerospace medicine team (three person primary care module) and when we add in a five-member trauma surgical team, and three-member critical care team you have a 10-person team. You can fit all of the equipment in a trailer and it sets up into a four-bed hospital.

This equipment is not considered war-time readiness material, its considered a training asset. It is possible to protect these things, so that if you were in a contaminated environment, you can create a safe zone inside of the tents that we would use. The other similar asset that we have in critical care transport.

LEADERS is an information system for pulling together information that already been collected (medical information) and using it for surveillance. The simplest application of it is that people are coming into emergency rooms, primary care clinics; the billing people code the diagnosis. All of this gets fed into a system, which analyzes that hospital based data. There are different modules, but the one that has probably had the best use is the coding for diagnosis. In New York, about a year ago, there was a plane that crashed coming out of JFK that lost an engine and before this hit the news, LEADERS picked up a spike of upper respiratory tract infection (URTI). There was a big cloud of smoke that went over a neighborhood in Brooklyn and people started showing up at the ER complaining of URTI symptoms. Before this hit the national news that a plane crash had occurred, there was actually a spike that was identified. That is in concept what LEADERS is. It was not designed to put new hardware in the hospitals; it was designed to access information systems that are already in there. Dr. Beninati's briefing slides are attached (Attachment #6).

Dr. Mackenzie wrapped up by saying that there is an interest in discussing more of the points brought up today and also finding out if we can help in anyway with the NIH consortium. Find out if there is anything this group can do to assist in that process, specifically with the rapid response teams or some of the information presented here. We are interested in LEADERS and learning what the status of that is. It is a potential software packet that the hospitals here in Maryland could use. The military spent an enormous amount of money developing this very sophisticated tool. It does not require too much additional effort on behalf of the people who enter the data (that is the benefit of it, it takes existing data that been entered and abstracts it).

Q: What is the status of the RFP and who would be the PI. Dr. Mackenzie responded by saying that we have not seen the RFP yet and it has not been decided who would be the PI.

A: (on behalf of the City of Baltimore) we can offer coordination.

The Baltimore City Health Department is working on developing a terrorist preparedness drill for Spring break of 2003 and that will be a major effort involving the University community, local military affiliations, and county health offices.

STOP PRESS NEWS 11/18/02

1) BDI funding is on hold pending new Department of Homeland Defense. It is uncertain where or in what format these $ will re-surface.
2) Texas A & M new Homeland Security Research Center has been funded.

Meeting adjourned and Rick Alcorta, MD took many of the attendees on a tour of the SYSCOM facility in MIEMSS headquarters.

How would the Rapid Response Team (RRT) respond to a Chem/Bio event?

- In Baltimore City?
- A military base in Maryland?
- In Washington, DC?

What resources could they deploy?

How quickly?

With whom could RRT coordinate?

Do RRT have authority in Washington, DC?

Do RRT have authority to function at all military installations in Maryland?

BioDefense Initiative (BDI) (Defense Threat Reduction Agency (DTRA)

Latest Speculation! $20 million to 10 areas

Baltimore City is 'on list'

Purpose of Funding

- Enhanced Biological Detection Capabilities
- Wide Area Environmental Monitoring
- Medical Surveillance Systems
- Fusion of Disparate Information Sources
- Consequence Management Tools

Competitive Applications – No blank $ checks!

Strengths in Baltimore City

- Baltimore City Biosurveillance Network
- Department of Health and Mental Hygiene – Syndromic Surveillance – Cap Beltway
- University's collaborations (UMB, JHU, USHUS)
- MIEMSS
- Shock Trauma Center Go Team, Air Force, Rapid Response Teams
- NSC/HF Research Mobile Imaging System

Strengths in Maryland

- **Military**
  Aberdeen Proving Ground – Edgewood RRT
  Ft Detrick – Combat Casualty – TATRC
  Ft. Meade – RRT with Aviation
  Maryland National Guard
- **MIEMSS** **FRED**
  e-MAIS
  RRT's – Hazmat, etc

Proximity to D.C., NSA, Walter Reed, etc

DOD – Biological Defense Homeland Security Support Program

One Effort is Biological Defense Initiative (BDI)
$240 million

Objectives:

Develop, Deploy and Test prototype urban monitoring system

Time Frame:

Demonstrate a potential model for national capability by June 2004

DTRA is establishing a testbed in Albuquerque, NM for BDI

BDI will:

- Demonstrate the feasibility of integrating disparate information sources.
- Provide allowable information to DMs and emergency response personnel at local, state and national levels.
- Build on the existing public health and public safety infrastructure.

JOINT COMMISSION ON ACCREDITATION OF HEALTH CARE ORGANIZATION

Standards for Emergency Management

Standard EC.1.4 – Effective January 2001
Describes how healthcare organizations will ensure effective responses to disasters or emergencies.

The plan addresses 4 phases of emergency management:

1) Mitigation
2) Response
3) Preparedness
4) Recovery

www.jcaho.org

Federal Emergency Management Agency (FEMA)

Planning and Disaster Information
State and Local Government planning guidance
Links to other Government and non-Government web sites
www.fema.gov

Office of the Surgeon General U.S. Army Medical Department
Updated worldwide WMD news
Medical References
Training, calendar, search capability and links
www.nbc_med_org

Centers for Disease Control (CDC) – www.cdc.gov

University of Maryland Health Sciences Library – www.hshsl.umaryland.edu
U.S. Army Soldier and Biological Chemical Command (SBCCOM)
Research and Development of emergency preparedness response, emergency training and response for Domestic Preparedness Program, testing and results of equipment and protection for 1st responders.

Common Symptoms of Exposure to Contaminants (JHCAHO)

- Nuclear – Nausea, fatigue, non-healing burns
- Biological – Flu-like symptoms – worsening with breathing difficulty, rash that progresses to ??
- Chemical – Pin-point pupils, vomiting, salivation, choking, blisters, ?? diarrhea

National Pharmaceutical Stockpile (96 items)

- Antibiotics – Cipro, Erythomycin, Gentamycin, 0.9% Nall IV fluids infusion sets, heplocks, gloves, sterile dressing, 4"-8", Tegaderm dressing and Bacitracin Ointment.
- Antidotes – Pralidoxine 600 mg/Atropine 2mg, Auto injector, Diazepam 10 mg – all multiple dose
- Cardiac & Respiratory Support – Dopamine 400 mg, Methylepreduisolove 125 mg, Albuterol metered inhaler, Morphine 10 mg, Lorazepan 2 mg
- Airway & Gastro?? – Nasogastric tube, suction apparition and catheters, manual resuscitator bag, airways, oxygen, mask, ??
- Other – Electric power strip , plus 90' extension cord, flashlight and batteries, fan and 50-gallon water tank, tissues and duct tape.

MEETING AGENDA

National Study Center for Trauma and EMS
University of Maryland School of Medicine
701 West Pratt Street – Room 531
Baltimore, MD

October 7, 2002
10 a.m. – 12 noon

AGENCIES/PARTICIPANTS

University of Maryland School of Medicine
Maryland Institute for Emergency Medical Services Systems
Medical Research and Materiel Command
Telemedicine and Advanced Technology Research Center
Department of Health and Mental Hygiene/State of Maryland
Health and Human Services

BACKGROUND

The climate and opportunity exists for collaboration between academia, state and government agencies for the purposes of maximizing resources in the areas of Homeland Security and Disease Surveillance.

PURPOSE

- Explore potential for Inter-Agency collaboration for Disease Surveillance
- Identify opportunities and capabilities of each agency
- Identify potential challenges for each agency
- Identify primary and secondary us for potential bio-surveillance network
- Identify other agencies with similar interest

October 7, 2002

October 7, 2002

Meeting on Homeland Security and Surveillance Initiatives
October 7, 2002
10:00 a.m. – 12:00 noon
National Study Center, 701 West Pratt Street, 5th floor

Participants

U. S. Army -- Fort Detrick
Conrad Clyburn, Chief of Program Integration (clyburn@tatrc.org)
Claudia Ogilvie (oglivie@tatrc.org)
Lt. Col. Mary Parker, MD (parker@tatrc.org)

Baltimore City Health Department
Ruth A. Vogel, Director Terrorism Preparedness, Baltimore City Health Department Commissioner's office
(ruth.vogel@baltimorecity.gov)
Nkossi Dambita (nkossi.dambita@baltimorecity.gov)

State Department of Health and Mental Hygiene (DHMH)
Jeff Roach MD, MPH (Rocheje@dhmh.state.md.us)

Center for Vaccine Development
James Campbell, University of Maryland, School of Medicine
(jcampbell@medicine.umaryland.edu) for Mike Levine, Director
(mlevine@medicine.umaryland.edu)

Center for Health and Homeland Security
Michael Greenberger, JD, Director, University of Maryland, Baltimore,
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Maryland Institute for Emergency Medical Services Systems (MIEMSS)
Richard Alcorta, MD, Medical Director
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Department of Epidemiology
Glen Morris, MD. Chairman, University of Maryland School of Medicine,
(gmorris@epi.umaryland.edu)

President Ramsay's Office University of Maryland, Baltimore
Mary Leach, PhD (mleach@umaryland.edu)

Deans Office University of Maryland, School of Medicine
Howard Dickler, MD, Associate Dean Research
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Infectious Disease Control Officer University of Maryland Medical System
Hal Standiford, MD, Chief (hstandiford@umm.edu)

National Study Center for Trauma and Emergency Medical System
Colin F. Mackenzie, MD, Director (cmack003@umaryland.edu)

Conrad Clyburn, Chief, Program Integration at the Telemedicine and Advanced Technology Research Center (TATRC) presented material on the Army capabilities in Technology Services, Robotics and other initiatives related to Homeland Defense, communications and surveillance. His slides will be forthcoming as a separate mailing. He was assisted in the presentation by Lt. Colonel Mary Parker, MD also of TATRC.

Each member present then briefly summarized their interests and areas of expertise starting with Nkossi Dambita, who described the City of Baltimore's Multifaceted Bioterrorist Surveillance System. This system traces on a daily basis non-specific and acute respiratory infections, febrile illness with flu-like symptoms (with and without rash/unusual diarrhea, lymphadenopathy, septicemia, pneumonia and death. Sources of information include: selected outpatient clinics, all eleven city emergency departments, all pre-hospital EMS calls, dog and cat carcasses collected by the Bureau of Animal Control, primary school absenteeism and specific over-the-counter medication sales from sentinel pharmacies.

Reporting is via e-mail and Internet distribution occurs to the Commissioner of Health, Mayor's Office, State officials, the Baltimore City Bioterrorism Response Team and others. It appears to be functioning well as an early warning system for biologic and chemical terrorism, but needs validation for specificity and sensitivity so that a benchmark can be identified for detecting aberrations and changing trends.

From the perspective of terrorism preparedness, Baltimore City is interested in "people networks" and obtaining current and frequently updated data. These human interactions are "low tech" but can have high yield. One needs to know at what level this early warning system deploys enough data to generate an emergency response. The health department, police, fire and Mayor's office are participating in weekly meetings to insure collaboration and cross training. The immediate need is training starting with staff. A spring exercise is planned. The push is for public information dissemination, e.g., Radiation Exposure.. A video has been developed together with a brochure.

Jeff Roche, MD, MPH represented the Office of Epidemiology and Disease Control Programs at DHMH. Before DHMH was funded by CDC to conduct syndromic surveillance for bioterrorism events, a system for receiving ER demographic and clinical information had been in place in the Maryland suburbs of the District of Columbia since September, 2001. This system, which is primarily manual, is now exploring ways to achieve electronic connections for greater reporting timeliness and efficiency. Also, this BT syndromic surveillance project does not at this time directly collaborate with the UM Department of Epidemiology (Chair, Glenn Morris, MD). Dr. Morris's projects are more directed toward monitoring certain food-borne communicable diseases. This 'Emerging Infections Program' or EIP is more broadly applicable to disease control, rather than biosurveillance or homeland defense; however, it does monitor several specific pathogens which have been included as within Category B of the CDC's Critical Biological Agents list."

Jim Campbell from the Center for Vaccine Development described the process of collaboration for submission of an application for the NIH Regional Center of Excellence. Funding for Biodefense and Emerging Infectious Diseases Research, (RFA # A0-02-031 at the National Institutes of Allergy and Infectious Diseases (NIAID), http://www.niaid.nih.gov with an

application with an application receipt date of January 15, 2003). He expressed interest in collaborations with Drexel University (PA), http://www.research.drexel.edu/preparedness, which was identified by TATRC as having expertise in sensor technology, for wide area surveillance for chemical and biological weapons. The University of Maryland School of Medicine will lead a consortium applying for this funding (see below under Dr. Dickler's comments). The component of this NIH funding of the Regional Center of Excellence will include: 1)investigator-directed research; 2) training researchers for biodefense activities; 3) developing and maintaining core facilities; 4) developing translational research capacity for testing and validating vaccine, therapeutic and diagnostic concepts for biodefense and emerging infectious diseases; 5) collaborating with qualified biotech and pharmaceutical industrial partners to perform research, testing and evaluation of vaccines, therapeutic and diagnostics for CDC categories A-C agents; 6) to be ready and available to provide facilities and support for first-line responders in the event of a national biodefense emergency.

Mike Greenberger, JD, Director of the Center for Health and Homeland Security (UMD) described how they are conducting a survey of the UM,B professional schools in the areas of policy, legal analyses and research that will be made available to the University and others, e.g., the School of Pharmacy is working with state pharmaceutical companies. The Health Sciences Library http://www.hshsl.umaryland.edu/ has a comprehensive web site on Terrorism Resources for the Health Care Community. This is currently for scientists, but they are working on developing it for use in public education. On November 20th President Ramsay will hold a Community Issues Forum titled "Homeland Security – Taking Control." Mike Greenberger also brought up the legal issues of civil liberties, bioethics and health law in relation to homeland defense.

Mary Leach, PhD from President Ramsay's office noted the multidisciplinary effort involved all seven schools on the UM,B campus. In addition, drawing on the strengths of all three campuses, UMB, UMBC and College Park are jointly exploring the development of a biomedical engineering program as well as medical informatics.

Howard Dickler, MD, Associate Dean School of Medicine described the consortium lead by the University of Maryland School of Medicine (SOM) (PI: Myron Levine, MD) that will submit a proposal to NIH for the Mid-Atlantic Center of Excellence for Biodefense and Emerging Infectious Disease Research, (RCE, RFA AI-02-031 from NIAID). Included in this SOM application will be collaborations from the medical schools in Virginia, Washington, DC, Baltimore and Pennsylvania (not all the PA schools are yet on board).

Rick Alcorta, MD, Medical Director, MIEMSS, identified the existing Emergency Medical Resources Center (EMRC) communication systems including: 1) the statewide microwave network that links every hospital and every emergency department in the state with the 911 centers and all EMS field providers; 2) the volunteer County Hospital Alerting Tracking System (CHATS) that identifies Regional Surge Response and Yellow Alert (emergency department over crowded) and Red Alert (no monitored inpatient beds available) status; 3) Maryland Ambulance Information System (MAIS), a runsheet completed for every patient transport in the State (air and ambulance). This is currently paper, but is being upgraded to an electronic e-MAIS format. It will potentially be a powerful surveillance tool available in near real-time; 4)

Facility Resource Emergency Database (FRED) identifies the availability of emergency resources electronically in near real-time and is currently under final evaluation. Disaster exercises are being conducted, and the next series will include the BWI Airport EXPLEX, the Baltimore County setailment, the Howard County pipe line explosion and Carroll County drug house explosions on October 19th and 20th .

Colin Mackenzie, MD, Director of the National Study Center for Trauma and EMS (NSC) (This material is summarized FYI, but there was not time left for presentation.) The NSC has a mandate from Congress to carry out surveillance (Public Law 94-476). We currently collaborate with local, state, national and federal agencies on injury surveillance. Surveillance techniques include use of confidential and unique databases (e.g., HSCRC, Trauma Registry, Toxicology, OCME autopsy reports, police crash reports, MAIS, hospital records, Bureau of Vital Statistics, etc.), which are related using probabilistic methods to develop techniques for injury prevention and control. Such methodology is readily adaptable to homeland defense surveillance if the data in these databases were abstracted and entered in near real-time. Such an opportunity exists with the University of Maryland Emergency Departments throughout the State of Maryland (Eastern Shore, Western and Southern Maryland and Baltimore City). This network has more than 450,000 visits annually and we believe that a minimal data set abstracted from existing data entered by ED physicians for billing purposes could function effectively for surveillance. Such a system would "add value" to the e-MAIS system described above and would enable evaluation of eventual outcome from ED visits and EMS pre-hospital care.

The NSC would make secondary use of these ED and EMS surveillance data for injury prevention and control in collaboration with our colleagues at The Johns Hopkins University Violence Prevention Program and our federal funding agencies, which include NHTSA, CDC and NIH. See http://nsc.umaryland.edu/.

In addition, NSC investigators have developed and are evaluating (in MIEMSS disaster exercises) electronic imaging and communication tools to assist in coordination of rescue agencies and personnel in emergency teams at disaster sites. See http://hfrp.umm.edu/.

It was suggested that the group should meet again to discuss more specific collaborative efforts, both to support the Center of Excellence collaboration and to support other Biodefense initiative efforts of $420 million for FY 03.

Next Meeting date: November 11th from 10 a.m. to 12 noon at the National Study Center for Trauma and EMS. Please send attendance responses to cmack003@umaryland.edu.

Articles

Articles

SPECIAL CONTRIBUTIONS

The Tokyo Subway Sarin Attack: Disaster Management, Part 1: Community Emergency Response*

TETSU OKUMURA, MD, KOUICHIRO SUZUKI, MD, ATSUHIRO FUKUDA, MD, AKITSUGU KOHAMA, MD, NOBUKATSU TAKASU, MD, SHINICHI ISHIMATSU, MD, SHIGEAKI HINOHARA, MD

Abstract. The Tokyo subway sarin attack was the second documented incident of nerve gas poisoning in Japan. Prior to the Tokyo subway sarin attack, there had never been such a large-scale disaster caused by nerve gas in peacetime history. This article provides details related to how the community emergency medical services (EMS) system responded from the viewpoint of disaster management, the problems encountered, and how they were addressed. The authors' assessment was that if EMTs, under Japanese law, had been allowed to maintain an airway with an endotracheal tube or use a laryngeal mask airway without physician oversight, more patients might have been saved during this chemical exposure disaster. Given current legal restrictions, advanced airway control at the scene will require that doctors become more actively involved in out-of-hospital treatment. Other recommendations are: 1) that integration and cooperation of concerned organizations be established through disaster drills; 2) that poison information centers act as regional mediators of all toxicologic information; 3) that a real-time, multidirectional communication system be established; 4) that multiple channels of communication be available for disaster care; 5) that public organizations have access to mobile decontamination facilities; and 6) that respiratory protection and chemical-resistant suits with gloves and boots be available for out-of-hospital providers during chemical disasters. **Key words:** sarin; disaster medicine; chemical warfare agents; emergency medical services; EMS; international medicine. ACADEMIC EMERGENCY MEDICINE 1998; 5: 613–617

THE TOKYO subway sarin attack was the second documented incident of nerve gas poisoning in Japan. The first mass public exposure to sarin (methyl phosphonofluoridic acid 1-methylethyl ester) gas occurred in the city of Matsumoto in June 1994.[1] From a worldwide historical perspective, the Tokyo subway sarin attack represents the largest disaster caused by nerve gas in peacetime history. Until these episodes, a terrorist attack with chemical warfare agents in a public setting was incomprehensible. Indeed, the Japanese believed that the Tokyo subway system was the safest transportation system in the world. As a result of this attack, many problems were encountered and the Japanese have been forced to radically alter their approach to disaster management.

We previously published a preliminary report on the Tokyo subway sarin attack.[2] The current article provides further detail related to how the community emergency medical services (EMS) system responded from the viewpoint of disaster management, the problems encountered, and how they were addressed. Companion articles address the hospital response[3] and the national and international responses[4] related to this event.

NATIONAL AND REGIONAL EMS SYSTEM

In Japan, disaster planning is based on the "fundamental law of disaster management." This law

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*Parts 2 and 3 follow in this issue of *Academic Emergency Medicine.*

TABLE 1. Patient Transport to St. Luke's International Hospital in Tokyo, Japan, after Sarin Gas Release

Mode of Arrival	Number of Cases (%)
On foot	174 (34.9%)
Taxi	120 (24.1%)
Car (passing good samaritans)	67 (13.5%)
Car (Tokyo Metro Fire Department) —excluding ambulances	64 (12.9%)
Ambulance	35 (7.0%)
Police patrol car	7 (1.4%)
Others	31
TOTAL	498

basically covers regional disaster planning and its management. In the Tokyo metropolitan area, the Tokyo metropolitan government is responsible for the regional disaster plan and its management. The Tokyo regional disaster plan is intended to provide initial medical rescue and backup support. Under this disaster plan, the Tokyo Metropolitan Fire Department (TMFD) is responsible for: 1) selection of the hospitals in which victims are to be taken; 2) transportation to supporting backup hospitals; and 3) first aid.

This plan also provides for initial rescue teams consisting of staff from metropolitan hospitals, the regional medical association, the Japanese Red Cross, national hospitals, and public health centers. In addition, it includes a wide-area backup system involving surrounding prefectures.

The TMFD is directly responsible for out-of-hospital care in Tokyo. There are a total of 182 emergency medical teams and 1,650 emergency medical technicians (EMTs) in Tokyo to deal with the needs of 10 million people and 5 million households in the 1,750-km^2 Tokyo metropolitan area.[5] Each emergency medical team consists of 3 attending EMTs, one of whom is an authorized EMT called an emergency life-saving technician (ELST). An ELST law in Japan established the ELST position in 1991. ELSTs may provide some advanced medical treatment (e.g., airway management with a Combitube or laryngeal mask airway, IV line placement, and cardioversion). By law, the ELST is prohibited from carrying out these procedures without the permission of a medical doctor. Therefore, the ELST must contact a doctor on 24-hour call at the Tokyo Metropolitan Ambulance Control Center (TMACC) to obtain the doctor's consent for each medical procedure. Endotracheal intubation by an ELST is prohibited by law. In 1995, 6,315 procedures were performed by ELSTs in Tokyo. There is no EMS physician field response system in Tokyo in which a doctor would respond to a disaster site in an emergency vehicle.

The TMFD has a corps of persons who specialize in chemical disasters (i.e., hazmat teams), who have chemical-resistant suits and their own chemical material analyzers, including an infrared gas analyzer and a gas chromatograph–mass spectrometer.

The Metropolitan Police Department also has a laboratory capable of identifying chemical materials with a gas chromatograph–mass spectrometer.

The Japanese Self Defense Forces are controlled by the Defense Agency, which cannot act without the consent of the prime minister (so-called "civilian control"). In a disaster situation, they can enter the disaster area and carry out rescue only after they have received a request from the local government and the consent of the prime minister. They basically cannot act spontaneously.

In Japan, there are only 2 poison information centers in the entire country to deal with inquiries from a population of 100 million. In Japanese university medical schools and medical colleges, the departments of acute medicine, pharmacology, anesthesiology, forensic medicine, public health, and hygiene share responsibility for toxicology cases. The Japanese Association of Clinical Toxicology is a community concerned with poisoning. In Japan, there are no independent departments of clinical toxicology.

Although initially overwhelmed by the sarin attack, the disaster plan and EMS system in Tokyo is considered one of the most sophisticated in the country.

ANALYSIS OF PROBLEMS

Onset of Tokyo Sarin Gas Attack. When the first emergency call came to the TMACC of the TMFD at 8:09 AM, it was reported that there were emergency cases at a subway station. Within an hour emergency calls came separately from 15 affected subway stations, and EMTs were dispatched to their geographically respective stations. At that time the TMACC did not realize that there was one cause for all of these calls.

Out-of-hospital Medical Treatment. Following the sarin attack, 1,364 EMTs and 131 ambulances were sent to the 15 affected subway stations.[6] The TMFD defined the Tokyo subway sarin attack as the largest disaster since World War II. The TMACC was in total confusion because incoming information regarding this disaster exceeded their ability to manage communications. As a result, the EMTs lost radio contact with the doctor at TMACC. No victims were managed with a Combitube or laryngeal mask airway, and only 1 patient received an IV line (in this case a doctor who happened to be present gave the order). All severely ill patients received intubation and adequate ventilation only after admission to hospitals.

Deployment of Concerned Organizations on Site. Within an hour, the police blocked free access around the affected subway stations. At the same time they collected specimens and started to analyze items left behind at the scene.

The TMFD established an emergency rescue quarter at the affected stations, but by then victims who were in the most severe condition, those who required endotracheal intubation, had already been transported to hospitals. In the emergency rescue quarter, "superambulances" (extra-large ambulances equipped with 8 beds) and large tents expandable with compressed air were set up.

Within a few hours, the Japanese Self Defense Forces were dispatched to decontaminate the subway stations and subway trains.

Triage on Site. Triage was done by EMTs at the affected stations. Victims were evacuated from the subway stations to the outside. Among victims whom EMTs had initially categorized as mild cases, however, there were some whose states worsened during transportation.[7]

At the time of the sarin attack, the TMFD had its own triage tags, but these were not used for the majority of the victims, who went to hospitals without the aid of the fire department.

The TMFD asked the regional medical association for aid. A total of 47 doctors, 23 nurses, and 3 clerks were sent to the affected stations in response. St. Luke's Hospital also sent 8 doctors and 3 nurses. However, by the time they reached the affected stations, there were no victims who needed emergency procedures including intubation. Doctors and nurses were mainly engaged in triage of less ill patients at those sites.

Identification of the Cause Material. About 2 hours after the initial chemical exposure, information misidentifying the material causing the victims' illness as acetonitrile was provided by the TMFD. This information later proved to be wrong. Finally, the police identified the material as sarin around 11 AM, because mass spectrum analyzed by a gas chromatograph–mass spectrometer was consistent with sarin in the database of the National Institute of Standard and Technology (USA). The TMFD and police both made efforts to identify the cause material. Although the police at last identified it, this information did not reach hospitals or the TMFD directly. Hospitals and the TMFD received the results of the laboratory from television news after 11 AM.

Decontamination on Site. There was no field decontamination of victims on site. Only decontamination of the affected subway stations and subway trains was done by the Self Defense Forces.

Secondary Exposure of EMTs. Of 1,364 EMTs, 135 (9.9%) showed acute symptoms and received medical treatment at hospitals,[8] which interfered with the rescue work. They wore standard work clothing without respiratory protection. Most of them started to have symptoms during transportation, and it is suspected that they were exposed in ambulances to the vaporized sarin from the victims' clothes. The ventilation in ambulances and minivans at first was poor, because the windows were shut. After the EMTs' secondary exposure appeared, an order was transmitted to completely open the windows of ambulances and to improve the ventilation of the emergency rescue vehicles.

Transportation of Victims from the Scene to Hospitals. EMTs transported 688 victims to hospitals by ambulances (452 victims) and minivans.[7] The rest of them, >4,000 victims, reached hospitals on foot or via taxis or private vehicles of good samaritans. During the period immediately after the sarin attack, radio-controlled taxis played a remarkable role in the transportation of patients. The means of transportation from the scene to St. Luke's International Hospital is provided in Table 1. Approximately 25% of the victims were transported by taxi.[9] Furthermore, 2 of 3 cardiopulmonary arrest victims were transported to our hospital via private vehicles passing a station. Appropriate guidance to private vehicles picking up the victims was not given by the authorities. This, in part, concentrated victims at St. Luke's Hospital.

Because of the chaotic state in the control center, EMTs were unable to get hospital availability information. As a result, some of them had to search for available hospitals on their own by using public phones. It took until midnight for the TMFD to determine how many patients were admitted and in which hospitals.

We also studied the number of victims received by St. Luke's Hospital from each station (Fig. 1). Tsukiji Station is the nearest station to St. Luke's Hospital (0.5 km), and the largest number of victims arose from that station. However, St. Luke's Hospital received its largest number of victims (>2.5 times that from the nearest station, Tsukiji) from Kodenma-cho Station, which is 3.0 km from St. Luke's. This clustering of cases likely occurred because of insufficient information about where and how many victims there were, and where and how many victims were being cared for at different hospitals.

Interhospital Transportation. The emergency capacity at St. Luke's Hospital was almost reached. If the number of victims at St. Luke's had been larger, transfer of victims to another hospital

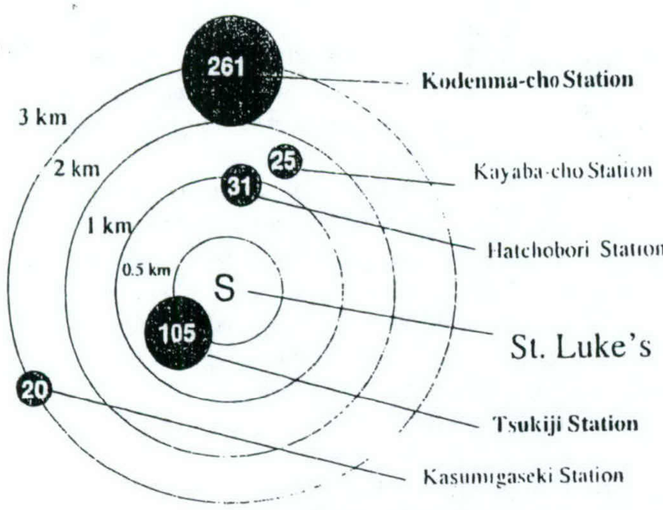

Figure 1. Victims received at St. Luke's International Hospital in Tokyo, Japan, after sarin gas release.

would have been necessary. We reviewed what would have been possible in such a circumstance. The TMFD, which should have provided interhospital transportation, could not do so because of a shortage of ambulances. A supporting backup system also was not available.

DISCUSSION

In the community EMS response, 3 major problems were exposed. The first problem was the limited out-of-hospital care imposed by EMT practice restrictions, the second was a lack of cooperation and communication among the organizations concerned, and the third was a general lack of preparedness for a chemical disaster, including the absence of decontamination at the scene and rescuer protection.

The ELSTs had the technical ability to optimize patient ventilation, but they could not use their advanced airway skills because of the legal restriction requiring prior physician contact. In a situation in which the control center cannot be contacted, it seems advisable for an ELST to use the concept of good samaritan actions (or independent practice) and practice to the fullest extent of his or her skills. However, the cultural climate of Japan does not allow such an approach. EMTs are highly hierarchically bound.

If ELSTs, under the law, had been allowed to maintain an airway with an endotracheal tube, more patients might have been saved. However, from the viewpoint of safety, when intubation is performed by poorly prepared personnel or under inappropriate circumstances, the procedure can be dangerous.

Given the restrictions of the ELST law in Japan, doctors should be more actively involved in out-of-hospital treatment requiring advanced airway care. The presence of a physician on scene might permit guidance of EMTs during intubation, whether via endotracheal tube or another technique.

During this disaster, the concerned organizations acted independently, and there was too little communication among them. The adverse effects of a vertically-structured EMS system were previously noted following the Hanshin great earthquake in January 1995, but the lesson was not learned.[10-12] Regional disaster plans emphasized the importance of mutual communication among concerned organizations, but a practical communication system was not established. Disaster drills exist in Japan, and each of the concerned organizations in Tokyo performs these drills. However, while disaster drills are held regularly by each concerned organization, there are no integrated drills including all of the concerned organizations. Integration and cooperation of the concerned organizations should be established through disaster drills.

Triage in chemical disasters, including nerve agents, is not easy, since there is delayed symptomatology that can be consequential. EMTs must be educated about the toxicologic aspects of chemical disasters. In particular, they should be repeatedly given the knowledge of chemical monitoring devices. Toxicologic education and investigation is one of the most important roles of the university medical schools and medical colleges, through the Association of Clinical Toxicology. These educational institutions along with hospitals, laboratories, hazmat teams, and Japanese Self Defense Forces personnel should share such information and opinions.

With this incident, the importance of the Japanese poison information centers and their current limitations became apparent. In a chemical disaster, poison information centers should be regional mediators of all toxicologic information. Specific information regarding cause material, counteraction, and decontamination should be gathered in poison information centers along with medical therapeutic information. The poison information centers should be able to rapidly distribute that information to hospitals, fire departments, the police, the public, and the mass media. At present, such a communication system, although needed, has not been established in Japan.[13]

Patient transportation is also based on exchange of information: How many victims? How severely ill or injured are the victims? Where are the victims located? How many victims need to be taken to a hospital and are likely to be admitted? Following the sarin attack, it took too long to answer these questions. A real-time and multidirec-

tional communication system should be established. There should be multiple channels of communication, so that if one channel breaks down, another channel may survive. Satellite-mediated portable phones, wireless communication, and an Internet network are good candidates. The number of the victims found was far beyond the transport ability of the TMFD. In such a situation, nongovernmental vehicles should be used. Furthermore, these vehicles should be guided systematically to hospitals that can accommodate victims, avoiding concentration at one hospital. Following the sarin attack, backup transportation did not exist. If there had been more victims or a larger number of severe victims, this would have become an enormous problem. During the period immediately after the sarin attack, radio-controlled taxis played a remarkable role in the transportation of patients, and their ability to collect information also cannot be minimized.

Following this attack, a new disaster report taxi system was initiated. Through this system, authorized taxis should report where and how disasters have arisen to a taxi control center via radio as soon as possible. However, poisoning of drivers in a chemical disaster has not been considered. This system is an information collection system rather than a rescue system. In any case, establishment of improved measures for communication during disasters will be essential.

Decontamination on site is essential for chemical disasters. Respiratory protection and chemical-resistant suits with gloves and boots are necessary for out-of-hospital treatment including decontamination. A public organization, such as the armed forces (in Japan, the Self Defense Forces) or a fire department, must prepare sufficient mobile facilities where victims can shower and change clothes. These facilities could be used not only for dealing with nerve agents but also for other chemical disasters and nuclear disasters. Such a mobile decontamination system has already come on the market in Germany.

Secondary exposure of EMTs occurred due to absent field decontamination and protection. Fortunately, the source chemical was a diluted form of sarin. If the source material had been sarin in its pure form, the resulting situation would have been more catastrophic.

CONCLUSION

We investigated the community emergency response to the Tokyo subway sarin attack from the viewpoint of disaster management. If ELSTs could, under the law, be allowed to maintain an airway with an endotracheal tube or use a laryngeal mask airway without physician oversight, more patients might be saved in similar chemical disasters. Under the restrictions of the ELST law in Japan, advanced airway control at the scene will require that doctors become more actively involved in out-of-hospital treatment. Integration and cooperation of concerned organizations should be established through disaster drills. In chemical disasters, poison information centers should act as regional mediators of all toxicologic information. A real, multidirectional communication system should be established. Multiple channels of communication should be available. Public organizations must have available some mobile decontamination facilities. Respiratory protection and chemical-resistant suits with gloves and boots are also necessary for out-of-hospital care during chemical disasters.

The authors gratefully acknowledge the invaluable assistance and support of the physicians, nurses, clerks, secretaries, and volunteers of St. Luke's International Hospital, Tokyo. They also thank Ilan Tur-Kaspa, MD, Chairman of the Advisory Committee of the Israel Ministry of Health on Hospital Preparation for Mass Casualty Toxicological Events, for suggestions, and Paul E. Pepe, MD, Jerris R. Hedges, MD, MS, and Mohamud Daya, MD, for critical review of the manuscript. The authors dedicate this work to all the victims of the Tokyo subway sarin attack and Matsumoto sarin incident in the name of St. Luke.

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The Tokyo Subway Sarin Attack: Disaster Management, Part 2: Hospital Response*

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Abstract. The Tokyo subway sarin attack was the second documented incident of nerve gas poisoning in Japan. The authors report how St. Luke's Hospital dealt with this disaster from the viewpoint of disaster management. Recommendations derived from the experience include the following: Each hospital in Japan should prepare an emergent decontamination area and have available chemical-resistant suits and masks. Ventilation in the ED and main treatment areas should be well planned at the time a hospital is designed. Hospital disaster planning must include guidance in mass casualties, an emergency staff call-up system, and an efficient emergency medical chart system. Hospitals should establish an information network during routine practice so that it can be called upon at the time of a disaster. The long-term effects of sarin should be monitored, with such investigation ideally organized and integrated by the Japanese government. **Key words:** sarin; disaster medicine; chemical warfare agents; emergency medical services; EMS; international medicine. ACADEMIC EMERGENCY MEDICINE 1998; 5:618–624

THE TOKYO subway sarin attack was the second documented incident of sarin (methyl phosphonofluoridic acid 1-methylethyl ester) nerve gas poisoning in Japan, the first episode having occurred in the city of Matsumoto in June 1994.[1] St. Luke's International Hospital was a major receiving hospital for the Tokyo subway sarin attack. Although St. Luke's Hospital had a disaster plan and disaster drills were carried out regularly, the disaster plan was mainly aimed at responding to fires and earthquakes. After Japan experienced the great Hanshin earthquake in January 1995, every hospital reconsidered its existing disaster plan.[2] At the time of the Tokyo subway sarin attack, St. Luke's Hospital was in the process of revising its disaster planning.

We have published a preliminary report on the Tokyo subway sarin attack.[3] That article contained little description of the hospital resource deployment that occurred during the sarin attack disaster. In this article we address the St. Luke's Hospital disaster management response, problems encountered, and how the hospital addressed these problems. Companion articles focus on the community emergency response[4] and the national and international responses[5] to this disaster.

BACKGROUND

Prior to the sarin attack, Tokyo had disaster planning, but it was mainly aimed at dealing with earthquakes, fires, and floods.[4] A chemical disaster had never been considered, especially one involving chemical warfare agents. Although the Matsumoto sarin incident had increased the awareness of chemical agent exposure, measures against such agents in Tokyo, 200 km away, were poor. The Japanese Self Defense Forces had a wide knowledge of chemical warfare agents, but few physicians in Tokyo knew anything about such agents before the Matsumoto sarin incident.

On the morning of March 20, 1995, 15 stations of the Tokyo subway system were filled with a noxious substance later identified as a diluted form of sarin gas. A total of 5 subway commuter cars were affected during the Monday morning rush hour. According to a traffic white paper, the capacity of subway trains between 8:00 AM and 8:40 AM reaches more than 200%. With such congestion,

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passengers cannot read opened newspapers, only magazines. The attack occurred at approximately 7:55 AM. The terrorists carried diluted sarin solution in plastic bags into the subway trains and simultaneously stuck the sharpened tip of an umbrella into these bags. There were 12 fatalities, and 5,500 more persons were sickened.

St. Luke's International Hospital, a private 520-bed facility, received the largest number of victims. The hospital saw 640 patients on the day of the attack and, in total, 1,410 patients in the week following the attack. Table 1 shows the patient volume on a daily basis for the first week. The hospital is located within 3 km of the affected subway stations. Figure 1 shows the location of St. Luke's Hospital in relationship to the affected stations.

TABLE 1. Patient Arrival during the Week after Exposure

Date	Number of Outpatients*	Number of Admitted Patients
March 20 (Mon.)	640	111
March 21 (Tue., holiday)	116	31
March 22 (Wed.)	319	10
March 23 (Thu.)	204	5
March 24 (Fri.)	90	3
March 25 (Sat.)	40	2
March 26 (Sun.)	1	2

*The number of outpatients includes only new case numbers (initial encounters); the number of admitted patients includes old cases.

ANALYSIS OF PROBLEMS

Hospital Capacity. When the first emergency call from the Tokyo metropolitan ambulance control center of the Tokyo Metropolitan Fire Department came into our ED at 8:16 AM, it was reported that there had been a gas explosion at a subway station. Preparations were begun for burn and carbon monoxide poisoning victims. At 8:28 AM, the first patient complaining of eye pain and visual darkness arrived at the ED on foot from the subway station. The first ambulance arrived at 8:43 AM. In the first hour, about 500 patients (including 3 patients in cardiopulmonary arrest upon arrival) were rushed to the ED.

The president and vice president of St. Luke's Hospital visited the ED, saw the chaotic state it

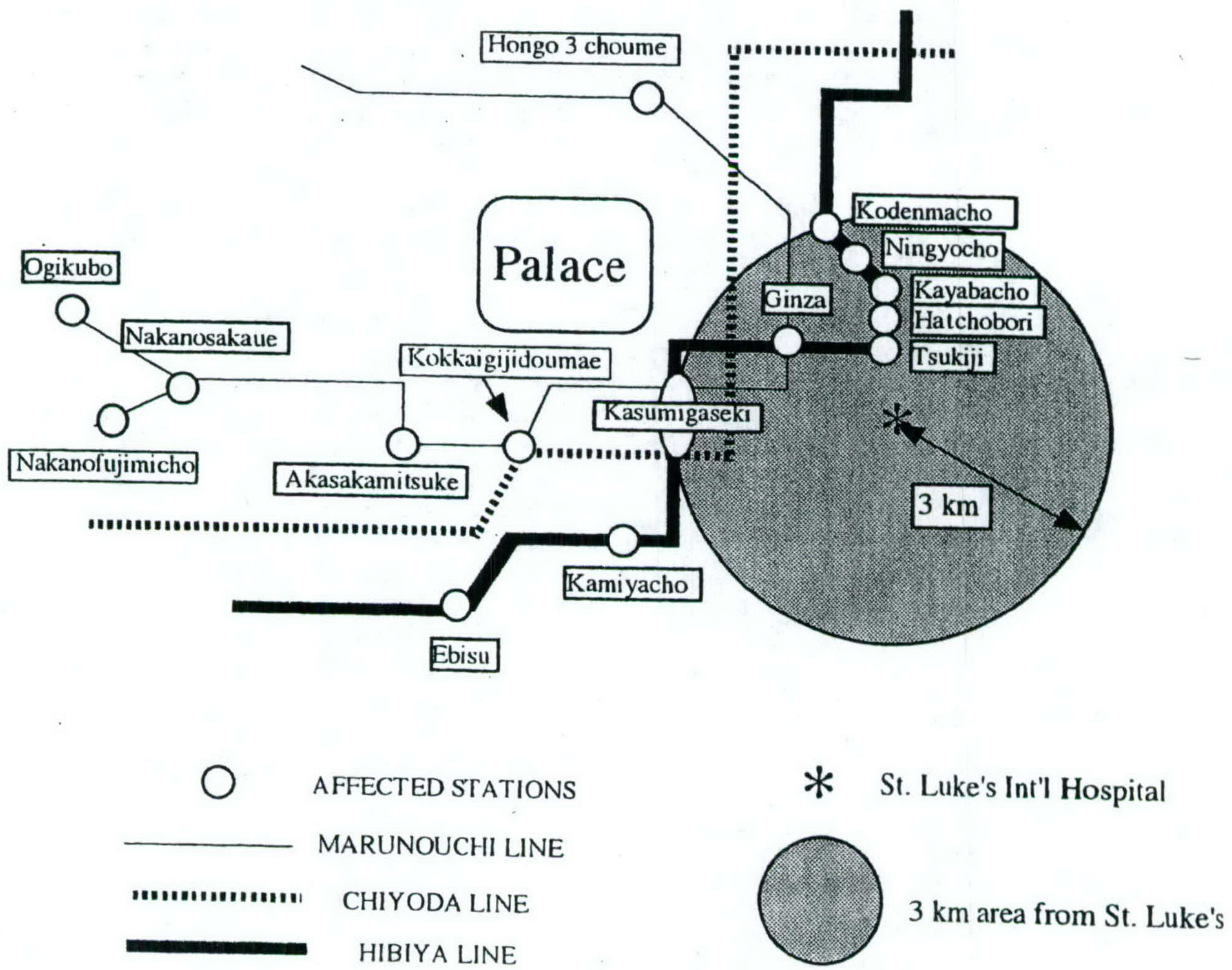

Figure 1. Affected stations and St. Luke's Hospital.

TABLE 2. Secondary Exposure Symptoms in the Hospital Workers (n = 472)

Eye symptoms	66 (14.0%)
Headache	52 (11.0%)
Throat pain	39 (8.3%)
Dyspnea	25 (5.3%)
Nausea	14 (3.0%)
Dizziness	12 (2.5%)
Nose pain	9 (1.9%)

was in, and knew the situation was extraordinary. They initiated a disaster-oriented system and declared a disaster situation when it was suspected that hundreds of victims would soon be arriving at the hospital. At that time all routine operations and outpatient examinations were canceled. A control center was set up in our ED. St. Luke's Hospital has 36 residents, 129 staff doctors, 477 nurses, 68 clerks, and an average of 30 volunteers a day. Off-duty staff members were called in, and the staff and students of St. Luke's College of Nursing were mobilized.

St. Luke's has approximately 2,000 outpatients daily, and the day of the attack was no exception. St. Luke's Hospital has 3 entrances, and victims, their families, their coworkers, television crews, and curious onlookers could enter from any of these doors. Therefore, the inner part of the hospital was in a chaotic state. We could not block free access because we had no definite plan for the guidance of mass casualties. When examinations were canceled, sufficient and repeated explanations were given and we called for the understanding of those at the hospital at the time. Printed information was distributed to the victims in an effort to reduce their anxiety level.

Medical Charting. At first, medical charts were filled out in the ordinary manner, but when >500 victims rushed into the hospital, we simply wrote down each victim's name, address, complaints, place of work, physical findings, and treatment, respectively, on a continuous sheet. Afterwards, these continuous sheets were put between the leaves of each patient's ordinary medical chart.

As a result, the medical records of some of the mildly affected patients got scattered and lost during this chaotic period. On the day of the attack we made a special summary sheet for admitted patients. This had a standardized format, and doctors filled in the patient's state of exposure (where, when, and how he or she was exposed), signs, symptoms, treatment, and outcome in accordance with check boxes.

Triage. At St. Luke's Hospital, triage was done mainly in the ED. As mentioned above, our hospital has 3 entrances, and triage was done at all these entrances. We divided victims into 3 categories: *mild*, ambulatory victims who presented with only eye symptoms; *moderate*, nonambulatory victims who presented with other systemic signs and symptoms; and *severe*, victims placed on mechanical ventilation. We closely observed 528 mildly symptomatic patients with an IV line for several hours in the outpatient department and then sent them home. There were 107 moderately symptomatic patients admitted to wards. There were 4 severely symptomatic patients admitted to our intensive care unit (ICU). One severe patient was nonreactive to CPR and died in the ED. Overall, triage was relatively simple and favorably done. Fortunately, the effects of sarin on the majority of victims were mild, and those severely affected appeared at the early stage of this disaster.

Decontamination. After it became suspected that nerve gas was the cause, we decontaminated the admitted patients by having them change clothes and shower. However, we were unable to decontaminate most mildly affected patients. This was in part because it took time to determine the cause of the victims' illness and in part because we did not have enough space for changing clothes and showering. No room has been set aside for decontamination in our hospital. Victims' clothes were packed in plastic bags, sealed up, and kept in the ward.

Secondary Exposure of the Hospital Staff. The hospital staff wore gloves and masks, but only those ordinarily used during operations and not for the setting of chemical contamination. We had no chemical-resistant clothing.

A study of secondary exposure of the hospital staff was carried out by means of a questionnaire.[6] The study items were sex, profession, symptoms, and the main place of work. Basically, members of the staff worked at one place. We sent the questionnaire to 1,063 persons, of whom 472 (44%) replied. Of these 472 persons working in our hospital, 110 persons (23%) complained of acute poisoning symptoms. All 110 persons with symptoms were female. Table 2 shows the symptoms, and Table 3 shows the secondary exposure percentages of various medical staff positions and various sites of care provision.

In St. Luke's International Hospital there is a chapel, in which O_2, aspiration, and compressed air outlets were installed. Many victims were managed in this area. Although this area is a useful emergency care site, ventilation is poor. As a result, 46% of the medical staff working in this area complained of acute poisoning symptoms. No increased ventilation was provided anywhere in the hospital during the first day. Fortunately, injury to

the hospital staff due to secondary sarin gas exposure was mild. Nobody needed medical treatment, although 1 nurse was admitted complaining of nausea, eye pain, headache, and dyspnea after working in the chapel all day long. This nurse recovered in a few days.

Antidote Storage. Initially we stored 100 ampules of 2-pyridine aldoxime methiodide (2-PAM) (1 ampule contains 500 mg of 2-PAM) and 1,030 ampules of atropine sulfate (1 ampule contains 0.5 mg of atropine sulfate). While this supply permitted initial treatment of the moderate to severely ill patients, our pharmaceutical department made an additional order to wholesale dealers at an early stage of the disaster. According to newspapers, 9,000 ampules of 2-PAM were transported from 1 manufacturer to Tokyo by air. We used 700 ampules of 2-PAM and 2,800 ampules of atropine sulfate. We used 1,000 mg of 2-PAM initially. For the victims whose symptoms continued, we used 500 mg/hr of 2-PAM until the symptoms disappeared.

Medical Information Transmission. We suspected that the cause of the victims' illness was some form of organophosphate agent exposure. We were puzzled as to why it had happened in the subway. The situation resembled the Matsumoto sarin incident of June 1994.

On the day of the Tokyo subway sarin attack, medical information came mainly from 3 sources. Table 4 shows the time course, information, and information sources. Information came first from the president of Shinshu University Hospital, who had experience with treatment of the Matsumoto sarin incident victims, via telephone and facsimile. Simultaneously, it came from a doctor sent from the Ground Self Defense Forces Hospital. Spontaneously, an interhospital network arose and functioned effectively. Low serum cholinesterase values, the signs and symptoms of the patients, the information from the doctors who had managed the Matsumoto sarin incident, and advice from the Ground Self Defense Forces Hospital led to a diagnosis of nerve gas agent poisoning. The third source of information was television news. It took 3 hours for the police to announce officially that the material was sarin, but the police did not inform us directly.

About 2 hours after the initial chemical exposure, misinformation indicating that the material causing the victims' illness was acetonitrile was provided by the Tokyo Metropolitan Fire Department, but there were no findings of acetonitrile poisoning (i.e., no methemoglobinemia) among the victims, so we ignored it. The Tokyo Metropolitan Fire Department has hazmat teams, who based their diagnosis on an infrared gas analyzer; however, their database did not include nerve agents at that point. The police finally identified the material as sarin by 11:00 AM based on mass spectrum analysis using gas chromatograph–mass spectrometer analysis, demonstrating that the agent was consistent with the spectrum of sarin as documented in a database of the National Institute of Standard and Technology (USA).

TABLE 3. Secondary Exposure Rates by Hospital Occupational Category and Site of Care Delivery

Occupational category	
Nurse assistants	39.3% (11/28)
Nurses	26.5% (45/170)
Volunteers	25.5% (14/55)
Doctors	21.8% (12/55)
Clerks	18.2% (12/66)
Site of care	
Chapel	45.8% (38/83)
ICU	38.7% (12/31)
Outpatient department	32.4% (34/105)
Ward	17.7% (14/79)
ED	16.7% (8/48)

In addition to the above information sources, we sought references in our own library, where MEDLINE and EMBASE are available. We also contacted the Japan Poison Information Center via telephone and facsimile regarding treatment. After as much information as possible was collected, the chief resident developed emergency guidelines for treatment. The staff of the ED repeatedly circulated to the wards to standardize the treatment.

Follow-ups. In March 1996, we sent a questionnaire to the 606 victims who came to our hospital on the day of the attack. Table 5 shows the results of this questionnaire.[7] Of the 606 victims, 303 replied. Of these, 46% still had some symptoms. Regarding physical symptoms, 19% of the victims still complained of eye problems, 12% of easy fatigability, and 9% of headache. As for psychological symptoms, 13% complained of fear of subways and 12% indicated fears concerning their escape from the attack. A medical checkup was carried out 1 year after the attack on 133 victims who wanted such a checkup.

DISCUSSION

The hospital response to this attack was particularly concerned with management of mass chemical casualties. We were able to initiate the disaster–oriented system at an early phase of this attack, so that our energies could be concentrated on this disaster. The canceling of all routine operations and outpatient examinations is an espe-

cially serious decision for a hospital to make. The cooperation and understanding of patients who were not victims made the success of this system possible. Also, fortunately, the Tokyo subway sarin attack occurred just after the workday began. As a result of these circumstances, we were able to manage this disaster relief without serious problems. We are pleased with the effectiveness of our teamwork.

However, some problems were exposed. Problems related to the hospital response can be divided into 3 categories: 1) hardware problems (structural problems of the hospital, including lack of decontamination facilities); 2) software problems (problems of disaster planning and its management); and 3) transmission problems (communication difficulties).

The most critical problem in the first category was the structural deficit of the hospital buildings. Secondary exposure seemed to have been due to poor ventilation and the lack of a decontamination area. Analysis of the results of the survey of secondary exposure of the hospital staff indicates that nurse assistants and nurses had a high incidence of secondary exposure, presumably because they were in more direct contact with victims. Regarding location, the chapel showed the highest incidence of secondary exposure. It is suspected that this was due to poor ventilation. The high incidence of secondary exposure in the ICU was thought to be due to the fact that this was where the most severely ill patients were cared for. Unexpectedly, the incidence of secondary exposure in the ED was relatively low. We suspect that this finding was due to better ventilation in the ED. Since many victims came in succession, the entrance of the ED was wide open. Confirming the condition of areas of patient management is important, and ventilation should be well planned at the time a hospital is designed.

If sufficient field decontamination is not done, some contaminated victims may reach hospitals by their own means. Ideally, each hospital should have its own decontamination facility, but such remodeling is expensive. As an alternative, a decontamination area outside the ED entrance could be

TABLE 4. Time Course of Events with Source of Information

Time	Event	Information Source	Information
7:55 AM	The attack occurred simultaneously in a number of locations.		
8:16 AM		The Tokyo Metropolitan Fire Department	Explosions occurred at subway stations.
8:25 AM	First victim came to ED on foot.	Victims	There was no explosion. Many people collapsed in the subway station.
8:40 AM	First ambulance came.		
8:43 AM	First cardiopulmonary arrest patient came by a private vehicle.		
	More than 500 victims were rushed to the ED.		
9:20 AM	All routine operations and outpatient examinations were canceled.		
9:40 AM	Cholinesterase level returned: very low.	The Tokyo Metropolitan Fire Department	Cause material is acetonitrile.
	Pralidoxime was started for severe patients.	President of Shinshu University Hospital	Sarin intoxication is suspected. (—treatment information—)
10:30 AM	First press conference was given.	Doctor from the Self Defense Forces Hospital.	Sarin intoxication is suspected. (—treatment information—)
11:00 AM		TV news: police announcement (There was no direct information from police.)	Cause material is sarin.
12:00 noon	Doctor conference was held to standardize the triage and treatment.		
2:00 PM	Mildly affected patients were sent home.		
5:00 PM	Transportation of the admitted patients was rejected by the Tokyo Metropolitan Fire Department.	The Tokyo Metropolitan Fire Department	Ambulances are not available for the victims' transport to other hospitals until midnight.
6:00 PM	Germany, France, and England offered the dispatch of rescue teams.		
8:00 PM	Final reconfirmation of admitted patients' information (name, address, severity, etc.) was done.		
10:00 PM	The list of the patients was announced.		

created by using present parking space for an emergent decontamination area. Respiratory protection and chemical-resistant suits with gloves and boots are also a necessity. Hospital workers who must care for victims of toxic chemical exposure and who have not been decontaminated should wear at least level C chemical-resistant suits and masks (according to the U.S. Environmental Protection Agency definition).[8] Such chemical-resistant suits including a mask are available commercially.

The most serious software problem was the lack of chemical disaster planning. The disaster planning of each hospital should include preparations for mass chemical casualties as well as fires, floods, and earthquakes. In a disaster situation, it is important to achieve blocking of free access to the hospital. One systematic stream from registration to medical chart making to triage to treatment is the principle of in-hospital disaster deployment. Furthermore, it is necessary in chemical disasters to distinguish between victims and other people.

Fortunately, we had enough antidote storage, which is a fundamental requirement for mass casualties from poisonings. We heard that some other hospitals did not have it, basically because organophosphate poisoning is rare in large cities. In addition to drug preparedness, respirator preparedness is also important in the care of nerve agent victims. Fortunately, because the cause material was a diluted form of sarin, the number of victims who required a respirator was relatively small. Had this nerve agent been used in greater concentration, a tremendous number of victims would have required respirators. Multiple respirator systems would be needed in such a crisis. One alternative would be to bag-ventilate multiple casualties during such emergencies. Securing human resources in general is essential for disaster management. An emergency staff call-up system for disasters is required and must be included in hospital disaster planning.

After our experience with this attack, we believe it is necessary to have an emergency medical chart system for disasters. Our new emergent medical chart consists of a sheet backed with hard paper with a neck strap and serial numbers. In Austria, Switzerland, and Germany, casualty information tags have been introduced. Paramedics and doctors write the various information about victims onto triage tags with serial numbers as an emergent chart. This system has the advantage of including information about both out-of-hospital care and hospital care. However, this tag system generally implies out-of-hospital tag placement. Until such a system is effectively implemented in a community, each hospital should have its own emergency medical chart system. As described above, on the day of the attack we created a temporary admission summary sheet, which was useful. Standardization of medical recording is also required.

TABLE 5. Residual Symptoms in Those Exposed Patients Available for Follow-up after One Year (n = 303)

Physical symptoms	
Eye symptoms	56 (18.5%)
Easy fatigability	36 (11.9%)
Headache	26 (8.6%)
Dullness	22 (7.3%)
Palpitation	13 (4.3%)
Psychological symptoms	
Fear of the subway	39 (12.9%)
Fear concerning escape from the attack	35 (11.6%)
Flashbacks	32 (10.6%)
Depressive feelings	24 (7.9%)
Lack of concentration	23 (7.6%)
Forgetfulness	21 (6.9%)
Nightmares	13 (4.3%)

The most significant problem in communication was the lack of an efficient chemical disaster information network. Transmission of medical information was especially important following this attack. The police, fire departments, the Japanese Self Defense Forces, the poison information center, and hospitals need to form an information network. The poison information center should provide general pharmacologic, pathophysiologic, and management information systematically. All the organizations concerned also should participate in disaster drills. In the hospital, to avoid further confusion and panic, adequate information should be provided to victims, families, and mass media crews repeatedly.

Not only acute phase information but also medical information during the chronic phase is important, since much is unknown about the long-term effects of sarin in humans.[9,10] One year after the attack, victims still complained of symptoms. Perhaps some symptoms can be explained by posttraumatic stress disorder. However, we believe it is important to investigate subtle subclinical neurologic changes, so we have begun to study subclinical neuropsychobehavioral effects with the Department of Public Health of Tokyo University.[11–13] The Japanese government, however, has not yet made any investigation of the long-term effects, leaving this task to each hospital. Preferably such investigations should be organized and integrated by the Japanese government.

CONCLUSION

We report the Tokyo subway sarin attack and how St. Luke's Hospital dealt with this disaster from the viewpoint of disaster management. Each hos-

pital should prepare an emergent decontamination area and have available chemical-resistant suits and masks. Ventilation in the ED and main treatment areas should be well planned at the time a hospital is designed. Hospital disaster planning must include guidance of mass casualties, an emergency staff call-up system, and an efficient emergency medical chart system. Fortunately on this occasion, the interhospital information network that arose spontaneously was effective. Hospitals should establish such an information network during routine practice so that it can be called upon at the time of a disaster. The long-term effects of sarin exposure should be monitored, with such investigation ideally organized and integrated by the Japanese government.

The authors gratefully acknowledge the invaluable assistance and support of the physicians, nurses, clerks, secretaries, and volunteers of St. Luke's International Hospital, Tokyo. They also thank Ilan Tur-Kaspa, MD, Chairman of the Advisory Committee of the Israel Ministry of Health on Hospital Preparation for Mass Casualty Toxicological Events, for suggestions, and Paul E. Pepe, MD, Jerris R. Hedges, MD, MS, and Mohamud Daya, MD, for critical review of the manuscript. The authors dedicate this work to all the victims of the Tokyo subway sarin attack and Matsumoto sarin incident in the name of St. Luke.

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The Tokyo Subway Sarin Attack: Disaster Management, Part 3: National and International Responses

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Abstract. The authors report the national and international responses to the disaster produced by the Tokyo subway sarin attack. From a worldwide historical perspective, there had never been such a large-scale disaster caused by nerve gas during peacetime. Therefore, this event should be studied from various viewpoints in cooperation with members of the international community. To this end, the Japanese government should help coordinate a large-scale and detailed investigation of the Tokyo subway sarin attack, including the long-term effects of sarin. The authors also recommend that the Japanese Self Defense Forces should be used more effectively in large-scale disasters. The system of direct control of disaster management by the Japanese government could be useful in a large-scale disaster. **Key words:** sarin; disaster medicine; chemical warfare agents; emergency medical services; EMS; international medicine. ACADEMIC EMERGENCY MEDICINE 1998; 5:625–628

OUR PRELIMINARY report on the Tokyo subway sarin attack[1] contained little discussion of the national and international responses to this disaster. In the present article, we address national and international responses to this emergency from the viewpoint of disaster management. This article complements companion articles addressing the community emergency response[2] and the hospital response[3] to this disaster.

BACKGROUND

Japan has suffered numerous natural disasters. The country usually experiences >30 typhoons every year. It is on the circum-Pacific earthquake belt, the so-called "ring of fire," and has many semi-active volcanos. Relatively speaking, however, there have been few man-made disasters.

Before World War II, in the setting of a disaster, martial law was proclaimed in Japan, and all authority was concentrated in the Imperial Japanese Army and Navy. They controlled first aid, life saving, and community restoration, and dispatched all the concerned official organizations.[4] After the war, democracy was established, and the Imperial Japanese Army and Navy were dissolved. In 1950, the Japanese Self Defense Forces were founded to replace them. Legally, the chief of the Japanese Self Defense Forces is the prime minister. Basically, the Self Defense Forces cannot act without the consent of the prime minister. Although they can enter a disaster area to carry out rescue work during a disaster when a request is made by the head of a local government, they cannot act spontaneously and their activities are highly restricted under civilian control. The Japanese people are sensitive about militarism or a concentration of authority. However, the Japanese Self Defense Forces have achieved much in the field of disaster relief. Every year, regardless of the size of disaster, they are dispatched 600 to 800 times.[5]

In Japan, disaster planning is based on the "fundamental law of disaster management." This law basically makes the wards of each metropolitan area, cities, towns, and villages responsible for regional disaster planning and its management.

ANALYSIS OF PROBLEMS

National Response. Following the Tokyo subway sarin attack, the Japanese government did not act

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TABLE 1. Numbers of Articles and Presentations Concerning the Tokyo Subway Sarin Attack*

	Domestic		International		
Year	Original Article	Abstract of Presentation	Article	Letter	Editorial
1997	7	1	5	3	0
1996	12	16	3	1	1
1995	28	20	3	6	1
TOTALS	47	37	11	10	2
	84		23		

*Data are based on findings on the Japana Centra Revuo and MEDLINE in September 1997.

in any substantial manner. Basically, all measures in response to the Tokyo subway sarin attack were entrusted to the governor of Tokyo. No official and organized headquarters existed to deal with this attack. The Tokyo Metropolitan Police, the Tokyo Metropolitan Fire Department, and the Hygienic Department of the Tokyo metropolitan government (directly responsible for metropolitan disaster planning) carried out their respective roles without central coordination.

The medical expenses of the victims who were on their way to work were covered by workers' compensation insurance. However, no comprehensive investigation of the victims was performed at the national government level. All investigation of the victims was dependent on the treating hospitals and their faculty. Each hospital has published reports of its experiences and presented them at academic meetings. Table 1 summarizes the volume of articles and presentations made in Japan and internationally.

Response of Japanese Self Defense Forces. Following the sarin attack, Japanese Self Defense Forces were dispatched to the affected subway stations and engaged in decontamination of these stations and subway trains at the request of the governor of Tokyo. The Japanese Self Defense Forces have a wide knowledge of chemical warfare agents and decontamination ability. They also have organizational skills and equipment (including mobile power sources) needed to carry out disaster relief effectively. In addition, they have the ability to establish communications and to organize a medical service corps quickly. However, at the early stage of this disaster, the full abilities of the Japanese Self Defense Forces were not used. Complicated formalities delayed the implementation of these forces. The same kind of delays had occurred a short time earlier following the great Hanshin earthquake.[4]

Although deployment of Self Defense Forces at the exposure scene was delayed, the response of the Ground Self Defense Forces Hospital was quick. About 90 minutes after the first victim arrived at St. Luke's Hospital, 1 doctor and 3 nurses were sent from the Ground Self Defense Forces Hospital. These personnel gave us the valuable information that a nerve gas agent was suspected as the cause material. They also provided treatment advice. We were fortunate that the legal restrictions that applied to the deployment of Japanese Self Defense Forces did not apply to self-directed actions by the doctors of the Ground Self Defense Forces Hospital.

Legal Issues. Following the Tokyo subway sarin attack, some legal problems arose. First, as described in a companion article, emergency medical technicians and emergency lifesaving technicians had the ability to give victims adequate ventilation by use of intermediate airway techniques,[2] but they could not use these skills because of legal restrictions. Second, the Japanese Self Defense Forces could not be deployed optimally because their deployment required local government to initiate the request.

In Japan, disaster planning is based on the "fundamental law of disaster management." This law basically covers regional disaster planning and its management. In the Tokyo metropolitan area, the Tokyo metropolitan government is responsible for regional disaster planning and its management. However, when the magnitude of a disaster is large, such regional disaster planning is ineffective. In such a situation, the cooperation of the self-governing body concerned is needed. Planning includes an area-wide backup system involving surrounding prefectures. But there are no concrete articles in the Japanese legal system providing for a single, coordinated headquarters for disaster management. All prefectures follow the same principle of local autonomy with regard to disaster relief. The governor of one prefecture cannot receive direction and supervision from the governor of another prefecture.[6]

International Response. On the day of the attack, Germany, France, and the United Kingdom offered to dispatch rescue teams. Within 2 weeks after the attack, investigative delegations came from 5 countries. Basically, since most, if not all, information on nerve agents involves military secrecy, the medical literature on these agents is limited. However, we were given valuable information from these countries that aided patient management.

Since the Tokyo sarin attack, nerve agents have been become a recognized measure of terrorism. Therefore, information on nerve agents has become open, and a manual for emergency medical services personnel has been published.[7]

Gulf War Syndrome Linkage. In recent years, the United States and other allied forces involved in Desert Storm have begun to evaluate the condition known as the Gulf War syndrome. A number of Gulf War veterans have complained of headache, diarrhea, easy fatigability, and sleeplessness since returning to the United States. The growing numbers of patients with these complaints cannot be ignored. As a result, President Clinton appointed an advisory committee to investigate this syndrome.[8] The Pentagon announced that when the American forces blew up a chemical agents facility, sarin was released in March 1991. It is suspected that tens of thousands of soldiers were exposed to that sarin.[9]

In January 1997, the advisory committee stated that there is no direct relationship between the syndrome and the nerve agents, and pointed out the possibility of psychological stress. However, it also stated that the possibility of an effect due to pyridostigmine bromide or low-level exposure to chemical agents could not be ruled out as a contributing factor, and agreed on the necessity for further investigation.[10] Given the interest in the Gulf War syndrome and possible linkage to low-level exposure to sarin, similar investigation of the long-term effects of sarin on victims of the Tokyo sarin attack will be valuable.

DISCUSSION

A large-scale detailed investigation of the Tokyo subway sarin attack, including the long-term effects of sarin, should be carried out by the Japanese government. In addition, information and advice regarding sarin should be requested internationally. We have begun to investigate the victims' persisting symptoms and/or neurobehavioral changes from an independent standpoint,[3] but in the absence of national or international support for these efforts, much valuable information may be lost.

The Japanese Self Defence Forces should be used more efficiently and in cooperation with the organizations concerned with disaster relief. The Japanese Self Defense Forces should routinely be involved in disaster drills as a means of encouraging their full participation in actual disasters. Regardless, during a disaster, cooperation between and integration of all concerned organizations are essential. After the Tokyo sarin attack, efforts have been initiated to permit the autonomous dispatch of the Japanese Self Defense Forces in response to major disasters.

In a disaster situation, unpredictable things can happen. Therefore, the laws governing emergency response should be interpreted flexibly according to the circumstances. Historically, the Japanese have a tendency to faithfully obey the letter of the law regardless of the circumstances.

A system by which the Japanese government could directly control disaster management would be useful in a large-scale disaster. When the disaster martial law was in force in Japan before World War II, all authority was concentrated in the Japanese Imperial Army and Navy. Such a concentration of authority may compromise democracy, but in the case of large-area disasters, a concentration of authority would be valuable. The development of a legal basis for the concentration of authority during major disasters is greatly needed in Japan.

The international response to this disaster was prompt and appropriate. From a worldwide historical perspective, there had never been such a large-scale disaster caused by nerve gas in peacetime. Such a disaster must be studied from various viewpoints in cooperation with the international community. For example, much is unknown about the long-term effects of sarin. Although some knowledge exists of the long-term effects of sarin on animals, there is little information about its effect on humans.[11] Follow-up of the victims of this large-scale exposure is essential for that purpose.

CONCLUSION

We investigated the national and international responses to the disaster produced by the Tokyo subway sarin attack. From a worldwide historical perspective, there had never been such a large-scale disaster caused by nerve gas during peacetime. Therefore, this event should be studied from various viewpoints in cooperation with members of the international community. To this end, the Japanese government should help coordinate a large-scale and detailed investigation of the Tokyo subway sarin attack, including the long-term effects of sarin. We also recommend that the Japanese Self Defense Forces should be used more effectively in large-scale disasters. The system of direct control of disaster management by the Japanese government could be useful in a large-scale disaster.

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End-tidal Carbon Dioxide Monitoring in Emergency Medicine, Part 1: Basic Principles*

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Abstract. End-tidal carbon dioxide ($PetCO_2$) monitoring is becoming more common in both the ED and the out-of-hospital setting. Its main use has been as an aid when confirming endotracheal intubation. However, since CO_2 is intrinsically coupled with states of metabolism, circulation, and ventilation, $PetCO_2$ monitoring along with analysis of its capnographic component is becoming increasingly valuable for other uses in the ED. This article reviews the physiology of CO_2, the means by which end-tidal CO_2 may be monitored, and the components and analysis of the capnogram. **Key words:** end-tidal carbon dioxide; capnometry; capnography; monitoring. ACADEMIC EMERGENCY MEDICINE 1998; 5:628–636

BECAUSE of its many roles, carbon dioxide (CO_2) is one of the most important molecules in the human body. Since its production and elimination are intrinsically coupled with the state of metabolism, circulation, and ventilation, the ability to rapidly monitor CO_2 can help evaluate and treat selected patients. We review the basic physiology of CO_2 and its measurement.

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BASIC PHYSIOLOGY OF CO_2

At normal temperature and pressure, CO_2 is an odorless and colorless gas. It exists in a concentration in air so small (0.03%) that the partial pressure is treated as if it were zero. CO_2 has a molecular weight of 44, reacts with water to form a weak acid, and is easily fragmented and ionized to form charged species.

The average resting adult produces approximately 2.5 mg/kg/min of CO_2.[1] Whole-body CO_2 clearance is achieved via alveolar ventilation, with blood transport occurring in 3 principal forms. The majority (60–70%) is transported as the bicarbonate ion after conversion in the red blood cell using carbonic anhydrase. Another 20–30% of CO_2 is bound to blood proteins such as carbamino compounds, of which the protein hemoglobin has the greatest CO_2-binding capacity. The remaining 5–10% of CO_2 is transported in physical solution in the plasma and is reflected by the partial pressure

Weapons of Mass Destruction Events With Contaminated Casualties

Effective Planning for Health Care Facilities

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Biological and chemical terrorism is a growing concern for the emergency preparedness community. While health care facilities (HCFs) are an essential component of the emergency response system, at present they are poorly prepared for such incidents. The greatest challenge for HCFs may be the sudden presentation of large numbers of contaminated individuals. Guidelines for managing contaminated patients have been based on traditional hazardous material response or military experience, neither of which is directly applicable to the civilian HCF. We discuss HCF planning for terrorist events that expose large numbers of people to contamination. Key elements of an effective HCF response plan include prompt recognition of the incident, staff and facility protection, patient decontamination and triage, medical therapy, and coordination with external emergency response and public health agencies. Controversial aspects include the optimal choice of personal protective equipment, establishment of patient decontamination procedures, the role of chemical and biological agent detectors, and potential environmental impacts on water treatment systems. These and other areas require further investigation to improve response strategies.

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The perceived threat of chemical or biological weapons directed against the US civilian population has increased substantially.[1-3] The designation of these weapons, along with nuclear materials and high explosives, as "weapons of mass destruction" emphasizes their potential catastrophic effect on the health of a large population. Comprehensive communitywide management programs for civilians exposed to chemical or biological warfare agents are still under development and many response issues have not been fully addressed. Health care facilities (HCFs) are an integral yet often overlooked component of the overall community response.

Although response requirements differ for chemical and biological agent releases, in both cases there might be situations necessitating the removal of the agent from exposed individuals (decontamination). We discuss the planning of an effective HCF response to incidents that require decontamination of exposed persons. Such a response must be coordinated within the entire community response framework, as in the incident command system, the most widely accepted command and control model for emergency response in the United States.[4] Events that are likely to challenge the decontamination capability of a HCF include 2 types of worst-case scenarios, chemical and biological.

With the release of a chemical weapon in a populated area, casualties may present en masse with little or no advance notification. The chemical agent deployed could be a traditional militarized agent (such as the vesicant mustard) or a more readily obtainable industrial hazardous material. As shown in the Tokyo sarin attack, a significant number of exposed individuals may find their own means of transportation to the HCF unassisted by emergency medical services (EMS).[5] These patients will not have undergone triage or decontamination, and the least injured will often present first. The HCF must have the ability to immediately decontaminate and treat those who are ill from the agent.[6] Some persons may have

For editorial comment see p 252.

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experienced very little exposure to the agent, or none at all. They may still require decontamination because exposure cannot be ruled out. Symptoms may be accompanied by anxiety and may be diverse and confusing.[5,7] Residual chemical agents on those exposed may pose a risk of secondary spread to the HCF and its workers by contact or vaporization.[8,9]

In a biological attack, an infectious agent may be released surreptitiously and discovered after the incubation period, when patients present with illness. However, if a biological attack is announced or discovered publicly as it is occurring, it could result in large numbers of patients suddenly presenting for services. In contrast with chemical agents, most biological agents (except mycotoxins) are not dermally active or volatile. Reaerosolization of infectious particles is theorized to be a low but possible risk.[10] Therefore, decontamination to lessen the effects of primary exposure and to prevent secondary exposure is less important than with chemical agents, but may be necessary.[11,12] The procedure could be as simple as taking a shower and changing clothes (exposure to mycotoxins would call for procedures similar to those used for chemical agents, including extensive patient decontamination).[13] A sudden biological event may require administration of prophylactic medications and vaccines and could place extraordinary demands on medical and public health staff and facilities.[14-16] We do not address the epidemiological investigation and large-scale measures needed to control infection in the event a mass exposure to infectious agents is recognized in a delayed fashion. Plans for HCF response to these types of events are under development.[11,17]

BACKGROUND

Until recently, any threat to civilians from hazardous materials (HAZMATs) primarily has come from industrial events.[18] While unintentional releases are relatively common, they generally cause few serious toxic exposures per event.[19] HAZMAT response guidelines have been developed and implemented for managing these incidents.[20]

The unintentional release of militarized chemical agents from US military depots has been another civilian concern. In response, a major preparedness initiative, the Chemical Stockpile Emergency Preparedness Program, has been implemented in communities surrounding the depots.[21] The response system has never been activated.[22] No similar community preparedness program for biological release has been developed, since the US military ceased maintaining biological weapons in 1972.[23,24]

The newly perceived threat entails the deliberate use of chemical and biological weapons against civilians. In many instances, these weapons are relatively easy to produce, inexpensive, and can be deployed covertly. Most significantly, the widespread terror caused by the use of these weapons could complicate response needs.[25,26]

The toxic and psychological threats posed by chemical terrorism were demonstrated by the 1995 sarin attack in the Tokyo subway system.[5,27] The assault resulted in 11 deaths and more than 5000 emergency medical evaluations, of which 73.9% had no identifiable clinical injury.[28] The majority of those exposed apparently had either a subclinical exposure or psychogenic symptoms. No chemical attacks of this nature have been reported in the United States.

No successful biological attack has occurred in the United States with an aerosolized agent, but other crimes and hoaxes involving biological agents have occurred.[29-31] The potential psychological effects of bioterrorism were demonstrated by the 1997 B'nai B'rith incident in Washington, DC.[32] A Petri dish found in the mail room of the B'nai B'rith headquarters was labeled to indicate the presence of *Bacillus anthracis* and *Yersinia pestis*. Responders and incident managers were unaware that nonaerosolized, agar-based organisms pose no inhalation or cutaneous exposure hazard (it was later proven that neither organism was present). As a result, an expensive scene-control operation took place, causing fear and inconvenience among those potentially exposed. Other recent biological hoaxes have also disrupted communities across the country.[33]

CURRENT CAPABILITY

As the potential threat of civilian exposure increases, the new challenge for the medical emergency response community will be managing contaminated mass casualties, some of whom may be ill. Many HCFs are poorly prepared for the decontamination requirements of even small-scale HAZMAT incidents,[34,35] as demonstrated by the temporary closures of well-run, full-service emergency departments after presentation of only 1 or 2 contaminated patients in 1997.[36] The most comprehensive HCF response plans to date were designed to cope with specific individual chemical or biological agents and radioactive nucleotides.[37]

Development of HCF response plans has been hampered by many factors. Foremost is the lack of civilian experience with mass casualty events of a chemical or biological nature. Many civilian plans are derived from the experiences of prehospital HAZMAT response teams or military defense procedures that may not be appropriate.

The HAZMAT approach assumes that responders will enter a highly toxic environment near the source of release (away from an HCF). Maximum protection is provided for a few workers rescuing a small number of patients, usually without time pressure for decontamination. The primary objectives are scene containment and environmental protection. In line with these assumptions, the Occupational Health and Safety Administration (OSHA) has mandated the use of a "Personal Protection Level based upon site hazards."[38] However, site hazards are more easily defined at the point of release than at the HCF, where patient care is conducted. Thus, current OSHA guidelines may be inappropriate for HCFs. Traditional HAZMAT products, such as decontamination tents, trailers, and isolation rooms, are expensive, require prolonged setup time, or are inadequate for large numbers of patients.[39]

Military countermeasures for chemical and biological weapons are also inappropriate for civilian use without modi-

fication. Military personnel are a more homogenous population, generally physically fit, mentally disciplined, and equipped for chemical warfare. Because they are designed for operations in very toxic environments, military contingency plans can be complex.[40] Incorrect civilian use of military protective equipment and decontamination procedures may be hazardous, as with the use of military-style gas masks by Israeli civilians during Gulf War missile attacks. Fatalities resulted from improper mask use.[41,42]

The US government has recently begun addressing civilian preparedness deficits. A 1995 presidential initiative funded the prototype for Metropolitan Medical Strike Teams,[43] which were composed of specially trained local personnel were organized to help communities respond to events. This effort has been revised to include a systems approach and has been renamed Metropolitan Medical Response Systems (MMRS). The overall goal of the MMRS program is to link first-response, public health, and health care systems. As a component of the MMRS, HCFs will remain responsible for initial management of contaminated patients. To date, 47 urban areas have received funding for development of an MMRS and more communities are expected to receive similar support.

The Nunn-Lugar-Domenici congressional legislation allocated federal funds to the Department of Defense to upgrade the capabilities of civilian first responders, including HCF personnel.[44] This Domestic Preparedness Program is being conducted serially in 120 metropolitan areas by the US Army Soldier and Biological Chemical Command.[45] This program is intended to provide operational-level preparedness, with educational tracts for community response entities, including emergency management, law enforcement, fire, and medical personnel. The current program for hospital personnel has lacked detailed operational methods.[46,47] A large-scale chemical agent exercise in New York City, conducted after hospital personnel had participated in the Domestic Preparedness Program, demonstrated that hospitals would still have difficulty managing patient decontamination.[48]

The federal government has established a National Domestic Preparedness Office (NDPO) under the auspices of the Department of Justice to act as a clearing house during responses to domestic chemical and biological terrorist incidents. The NDPO will handle information pertinent to law enforcement, emergency medical response, medical, and public health sectors.

Federal preparedness initiatives have been paralleled by private industry's development of chemical and biological agent response products and training programs. Self-described expert consultant groups offer risk analysis and training for various components of local emergency response, including HCFs. Some programs market equipment packages supplied by vendors working in conjunction with the consultants.[49] Most offer operational guidelines based on traditional HAZMAT procedures. As yet, no published large-scale exercise or response experience has validated these programs.

PROPOSED HCF CONCEPT OF OPERATIONS

Owing to the complexity of a civilian event involving chemical or biological weapons, HCFs should begin by delineating priorities that guide their preparedness process. These objectives should be established in coordination with the other members of the community involved in emergency response. The priorities of the HCF could be ranked in this order: (1) protection of the current patients, staff, and facility; (2) provision of the best possible medical care for contaminated patients presenting to the institution for care; and (3) environmental protection external to the HCF. In a large-scale event, containment of wastewater will probably be impossible, though no consensus has yet been reached on this controversial point. This issue should be addressed through comprehensive planning that includes local environmental and water authorities.

Certain assumptions can be made to simplify planning. One is that the exposure site is remote from the HCF (ie, the HCF is receiving patients but is not within the primary release area). Otherwise, facility evacuation or "sheltering in place" may be indicated. Key components of the model preparedness plan are illustrated in the FIGURE.

Event Recognition

In an unannounced event, it is essential to recognize contaminated patients before their entrance into the facility. Security personnel must be trained in early recognition and should be stationed at the hospital entrances. Security personnel should immediately notify management personnel when they suspect a problem, and they should be prepared to protect themselves by donning personnel protective equipment (PPE). Even so, it is reasonable to expect some contaminated individuals may gain entrance into the facility. These situations should be handled on a case-by-case basis with a rational approach. It will not be necessary to completely seal off the facility or a department in most circumstances.[50]

Activation of Plan

The alert mechanism should be expeditious: PPE must be immediately accessible to decontamination and patient care personnel, and the decontamination facility should be operational within 2 to 3 minutes.

Management

The principles of the incident command system should be incorporated into the HCF's emergency preparedness plan.[51] The use of this system will enable HCF staff to fully integrate their activities with community emergency response assets, since it is widely used by fire, EMS, and police personnel as well as many state and federal agencies. Although initial response efforts will be centered in the decontamination and treatment areas, other HCF departments will play vital roles. For instance, security officers must direct the flow of casualties and vehicles to prevent facility compromise and must prevent unauthorized access to the decontamination and treatment areas.

Personnel from departments including emergency, critical care services, plant operations, pharmacy, supply services, infectious disease, respiratory therapy, laboratory, and toxicology must be targeted for education and training in the response plan.

A widespread chemical or biological incident will result in extended operational periods. Staff should be coordinated to provide relief from physically taxing activities such as patient decontamination. Providing food and hydration in a hygienic manner will enhance staff performance. Psychological support for staff should be available.

Personnel caring for contaminated patients should be properly outfitted in PPE. Specific data to determine the appropriate level of hospital worker protection remains limited, and a recent extensive review on chemical and biological terrorism published by the Institute of Medicine is inconclusive on this issue.[52] Level C PPE consists of a nonencapsulated, chemical-resistant suit, gloves, and boots, with a full-face air purifier cartridge mask (powered or nonpowered). This gear should afford adequate respiratory protection for outdoor exposure to contaminated chemical casualties who have survived transport to the HCF.[21,53] For HCF workers conducting decontamination of patients acutely contaminated with infectious biological agents, level D protection (standard work clothes) plus latex gloves, eye splash protection, and N-95 respiratory masks (used in many hospitals for protection against tuberculosis) should be adequate.[54,55] If responders are concerned about reaerosolizing an agent during clothing removal, a high-efficiency particulate air (HEPA) filter mask could be added. If the agent class for a sudden release cannot be identified, level C PPE with an organic vapor/HEPA filter cartridge mask is recommended.

Training is essential for the correct use of PPE. Work times and conditions must be monitored while personnel are using PPE to prevent fatigue or heat stress. Personnel should be rotated if decontamination operations are prolonged. Once patients have been decontaminated, they may be handled by staff using universal precaution guidelines.

Crowd control will require firm, authoritative direction from hospital security and, if available, police or the National Guard. Since PPE face masks muffle the voice, loudspeakers should be provided to personnel directing contaminated patients. Signs designating functional areas and providing patient instructions should be in place.

Primary Triage

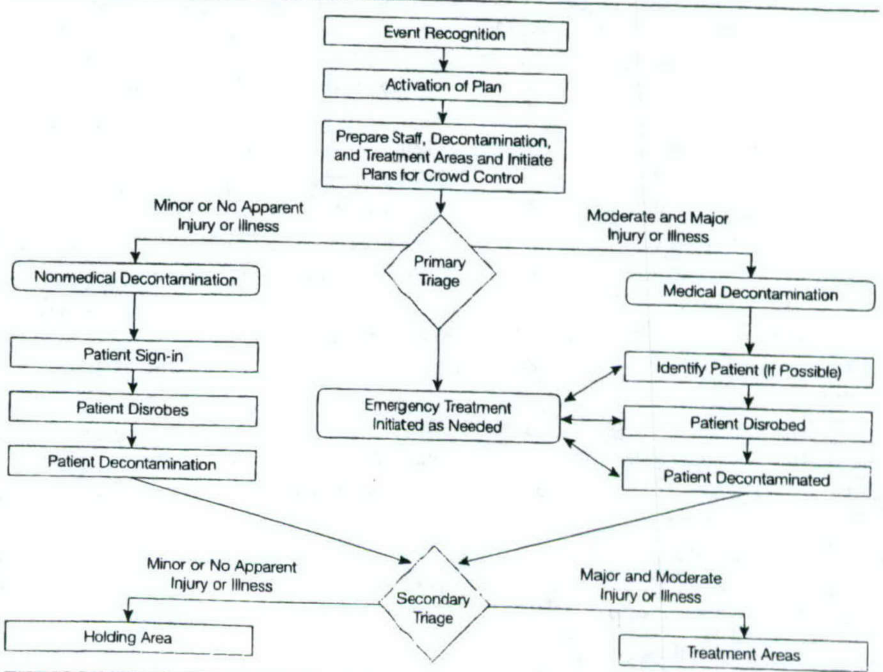
All exposed and potentially exposed individuals should receive an initial brief triage, performed by medical personnel in PPE, before decontamination. They should then be directed to 1 of 2 areas, nonmedical decontamination or medical decontamination. The uninjured, those with minor injuries requiring no medical intervention during decontamination, and the majority of ambulatory patients will be assigned to nonmedical decontamination. These individuals may require nonmedical assistance with washing themselves (eg, unaccompanied children, persons in wheelchairs, and those with other special needs). Those with injuries or illness potentially requiring medical intervention will be assigned to medical decontamination by staff.

Throughout the decontamination process, attention must be given to symptoms of exposure to chemical or biological agents that may indicate early life-threatening deterioration (eg, a sore throat or mild shortness of breath after exposure to pulmonary or laryngeal irritants).

Patient Sign-in/Identification and Securing Property

A brief sign-in process should capture name and date of birth (full registration can occur after decontamination and should be consistent with the community patient tracking system). A number on a log can be assigned to each patient, who would receive 2 identically numbered plastic bags and a nonpermeable wristband. Clothing would be placed into the larger clear, impervious bag. Separation of valuables into the second, smaller bag would enhance the security of these items. A meticulous, practical method of cataloging belongings will ensure their return and possibly assist in forensic investigations.

Figure. Health Care Facility Response Plan for Chemical or Biological Weapons Release



Patient Decontamination

The HCF should possess partially fixed or preconstructed decontamination facilities that can be activated immediately. This facility should be designed to occupy little storage space and not disrupt routine operations while in use. The Israeli model, developed during the Gulf War, consists of showers permanently fixed to the ceiling structure of an open-air parking garage or the side of a building.[56] The George Washington University Hospital model uses fire exit alleyways. An outdoor decontamination facility can prevent entry of contaminants into the HCF and obviates dedicating space with room ventilation and vapor isolation. An outdoor facility is also more suitable for the influx of mass casualties. Outdoor decontamination, however, must offer protection from inclement weather and have adequate lighting for night operations.

Because clothing will be removed before decontamination, privacy must be protected to ensure compliance with full decontamination. The sexes should be separated, with a visual barrier between shower lines. The need for protection of privacy was demonstrated by a successful lawsuit against a fire department whose personnel decontaminated 2 women without ensuring adequate privacy.[57]

Another important consideration is rapid patient progression through the decontamination process. Traditional HAZMAT decontamination is passive (using 2 responders to clean each patient), which is time consuming and unnecessary for the majority of ambulatory patients in the nonmedical decontamination area. Promoting patient self-decontamination will significantly decrease the required number of health care workers. Of course, decontamination assistance for some patients in the nonmedical decontamination area and full passive decontamination in the medical decontamination area must still be available.

Decontamination facilities should contain multiple shower stations that are designed to allow patients to progress at various rates without compromising overall flow. Patients whose clinical condition deteriorates in the decontamination line can impede the progress of others. Plans must include means for sidetracking these patients into an area separate from the main decontamination sites, where treatment can be initiated.

Decontamination can be accomplished by using a sequential copious warm water rinse, a hypoallergenic liquid soap wash, another warm water rinse, and then a final rinse after walking past other in-use showers. Incapacitated patients will require soap and water cleansing by staff, with attention to washing and rinsing the patient's back and the nonabsorbent backboard. The water temperature must be adjustable. Excessively warm water should be avoided, as this may promote peripheral vasodilatation and toxin absorption. Stiff brushes or abrasives should also be avoided as they may enhance dermal absorption of the toxin and can produce skin lesions that may be mistaken for chemical injuries.[58,59] Sponges and disposable towels are affordable and effective alternatives.

Secondary Triage

Persons with major or moderate casualties would be referred to treatment areas designated for such cases. Those with minor or no apparent injuries should be sent to a holding area for further evaluation, observation, and eventual treatment if needed.

Holding Area

Large spaces such as cafeterias or auditoriums can be used for observation of large numbers of patients with minor or no apparent injuries and illnesses by physicians and nurses. At this time, HCF staff should also provide information on the agent involved, potential short- and long-term effects, recommended treatment, stress reactions, and possible avenues to further assistance. It is essential to provide important information in writing because the memory of patients may be impaired by the psychological stress of dealing with an exposure. All potentially exposed individuals should also be enrolled in a long-term surveillance program to monitor possible health effects.

Logistics for Treatment

Specific therapies for chemical and biological agent casualties vary according to the etiologic agent and are described elsewhere.[15,16,60,61] Mass casualties requiring specific chemical antidotes, vaccinations, or antibiotics will quickly deplete available supplies. In most cases, current hospital stocks of medications would be inadequate to meet the needs of even a few of these patients.[62] Several efforts are under way to address this problem, including a federal initiative to stockpile antibiotics and vaccines.[63] Other concerns have not yet been adequately addressed. After a smallpox release, for example, postexposure vaccination might be indicated, but smallpox vaccine is no longer produced and current stocks are limited.[16,64]

Otherwise straightforward medical problems, including eye injuries, bronchospasm, and burns, may also need mass intervention. Ventilators and other critical care supplies may be needed in large quantities. This problem could be resolved in part through mutual aid agreements between HCFs. Such an agreement established in the Washington, DC, area provides for pooling of resources (including personnel, supplies, and equipment), and sharing of information.[65] Contingency plans of this type may be vital to saving lives, since time constraints prevent reliance on resupply support from state and federal agencies during the initial crucial period of an event.

Epidemiological Considerations

Health care facility involvement will extend beyond the treatment of patients who are acutely ill or exposed. A comprehensive community response will include epidemiological analysis undertaken by local and national public health organizations to identify all potential exposed individuals. This should be done during the brief interval when early intervention can save lives and containment can reduce secondary transmission of contagious agents. Such

analysis will require participation by HCFs.

Information Resources

Health care facility personnel must identify sources of expert information on chemical and biological agents to ensure ready access to such information. Ideally, a repository or data bank could be established at the community or national level. This would allow for the distribution of uniform information.

Other resources include medical management handbooks developed by the US Army's chemical and biological defense medical laboratories.[54,60,61] Some civilian-based protocols, such as pediatric recommendations, have also been established; these are currently being revised by the US Public Health Service.[66] Consensus statements organized by the Working Group on Civilian Biodefense also provide useful guidance.[15,16] Consultation is also available 24 hours a day by remote access through the National Response Center at (800) 424-8802.

Public Information

Prompt attention must be given to information issued to the public through the news media and bulletins. Media inquiries must be carefully handled, and the content of these communications should be discussed with appropriate emergency management authorities to prevent the release of conflicting or erroneous reports.

Postincident Actions

Following the event, HCF management should conduct an incident review with hospital personnel involved in the emergency response. The purpose of such a review is to determine, in a nonpejorative manner, the sequence of events and to disseminate the rationale behind controversial decisions. Exposure risks and necessary countermeasures should be discussed to alleviate some of the psychological impact of incident stress. The incident critique, which will take place later, is a technical review designed to evaluate and improve the response plan. The staff should also have access to formalized stress debriefing at a later date.

Because injuries and illnesses sustained during the response would be covered under employee compensation insurance, all staff members involved should be registered in a health surveillance program. This will ensure that medical issues will receive proper attention, and demonstrate the HCFs commitment to employee health. In view of the possible delayed or chronic effects of some chemical agents, surveillance could continue for years. Assistance for this type of surveillance is available through the Agency for Toxic Substances and Disease Registry, which the US Department of Health and Human Services has identified as the lead agency for the registration of personnel exposed to chemical or biological warfare agents.[67]

It will be essential to clean the decontamination facilities and process the possessions of contaminated patients, as well as dispose of solid waste. Cleanup will be guided by the specific agent involved and the law enforcement investigation. If no adequate, financially viable method is available to inactivate a highly toxic, persistent agent such as the nerve gas VX, assistance may be required from other local, state, or federal entities.[68]

CONTROVERSIES AND RESEARCH REQUIRED

Personal Protective Equipment

One major question concerns the optimal approach to PPE. To simplify guidelines and reduce confusion about the variety of choices, PPE recommendations could be standardized. This measure would ease financial disincentives as well as training requirements. Although published research on adequacy of PPE is limited, the consensus emerging among researchers and medical planners is that level C protection (using a full-face mask with powered or nonpowered canister filtration system) is adequate for HCF workers.[21,68,69] A few reports recommend a higher level of protection, level B, which includes a mask supplied by an external air source (hose-supplied air with an escape cylinder or a self-contained air tank).[70] However, these reports do not mention whether higher levels of protection produce a quantified increase in safety, nor do they discuss the possible disadvantages such as additional cost, weight, and training requirements.

Choosing a specific material to provide chemical barrier protection for HCF personnel is difficult. Many types of chemically resistant suits are available. They vary in cost and each has unique properties.[71] Industrywide testing is based on permeation rates of pure substances directly applied to the material, but such data may not be relevant to the exposure in the HCF response model.[72] Health care workers remote from the impact site or incident scene will be exposed only to the agent that remains on the skin and clothing of those exposed, so concentrations of substances encountered during decontamination at the HCF will be more dilute than concentrations used for the testing PPE materials.[68] Less expensive barrier materials may therefore be adequate.

Decontamination Solution

Another controversial concept concerns patient decontamination. Should decontamination be simplified by establishing a universal process for all incidents, as suggested by Cox?[71] Some authors have already published universal decontamination protocols for chemical exposures.[50] There is little argument that soap and water will be effective for most agents. In the past, an agent neutralizer such as a 0.5% solution of hypochlorite was recommended. It inactivates biological agents (except mycotoxins) and, at a slower rate, chemical agents such as mustard and organophosphates.[13,60,61] The studies indicate, however, that 15 to 20 minutes of contact time is necessary for hydrolysis or oxidation and, thus, for the inactivation of chemical agents.[60] Furthermore, dilute bleach can cause tissue damage in open wounds, exposed nerve tissue, and the eyes.[13,73] The lack of clear safety and efficacy data for bleach decontamination suggests that

it should be avoided, especially if soap and water are immediately available. There may be rare exceptions to a universal decontamination process. For instance, pure metals and strong corrosives require dry decontamination (ie, gentle brushing or vacuuming of larger particles) before water is applied.[68,74]

Agent Detectors

Yet another controversial issue is what role agent detectors should play in an HCF response plan. Agent detectors and monitors are used in the military and HAZMAT/EMS arenas. In the HCF environment, however, they would only complicate and lengthen the decontamination process. Much of the monitoring and detection equipment for chemical and biological agents is expensive and training intensive. Even handheld assays require attention to standard protocols. Moreover, some agent detectors can give false-positive readings when perfume, diesel vapors, or nonthreatening contaminants are present.[75] In some cases, cool air, the presence of a nonmilitarized agent, or other factors can produce false-negative results. Detection can also be time consuming. If an HCF is operating without any means of detection, HCF personnel must consider that most biological agents and some selected chemical toxins (eg, mustard) have delayed clinical manifestations. Contingency plans must include the capability to treat potentially exposed persons, if indicated, while confirmatory tests are under way.

Decontamination Wastewater

Questions have also been raised about the potential environmental impact of releasing decontamination wastewater into the water treatment system. To date, the Environmental Protection Agency has not published an official statement on this issue in relation to HCF planning. The decision not to contain wastewater can be justified for most agents in a life-threatening mass casualty situation. Biological agents may pose only a temporary risk to the environment or to the people in the area because of rapid environmental degradation or difficult reaerosolization.[10,13] On the other hand, a large-scale chemical incident usually results in significant environmental pollution; the amount of agent borne by patients presenting to HCFs will constitute only a small fraction of the total environmental burden. Some authors suggest that as much as 75% to 90% of the hazardous agent may be removed by disrobing.[70,71,75] The remaining skin contaminant may be minuscule and can be diluted further during washing and passing into public wastewater systems. The installation of a large-volume wastewater containment system is a prohibitively expensive undertaking. Even if installed, the final disposition of wastewater containing hazardous materials can be a catastrophic financial burden. If the facility design does not provide wastewater containment, appropriate water authorities should be notified at the time of the event.

Unanswered Questions

These and other pressing questions must be investigated if research is to help improve response strategies:

- What are the actual risks to first responders, clinicians, and other health care workers from reaerosolizing biological agents on contaminated clothing, skin, or environmental surfaces?
- What is the minimum adequate amount of washing/rinsing time required for adequate decontamination from most agents?
- What are the specific limitations of level C and level B PPE for HCF personnel caring for exposed patients removed from a site where a chemical or a biological agent has been released?
- What are the ideal avenues through which HCFs can disseminate information during an event of this type or magnitude?
- What equipment and training requirements can HCFs realistically support for this preparedness? Should public policy provide funding for HCF preparedness?
- Does every HCF in a defined area need this preparedness capability?
- Are there specific chemical and biological agents (in the amounts carried by contaminated patients presenting to HCFs) that cannot be safely washed into public water runoff?

CONCLUSION

The threat of a large-scale incident involving intentional release of chemical or biological agents in the United States is significant, but currently, no practical models exist for HCF response to a suddenly recognized event requiring the decontamination of mass casualties. The time has come to establish a forum of experts to address the questions presented in this article and elsewhere and to reach a consensus on how to develop and disseminate comprehensive guidelines for HCFs. These solutions should be fully integrated into the community response plan for chemical or biological terrorism.

Precedence for this consensus approach may be found in the method used by the Federal Emergency Management Agency for the creation of the National Urban Search and Rescue System.[76] Above all, the process must be an operationally oriented cooperative effort and remain uninfluenced by financial gain and unproved technologies.

The threat posed by chemical and biological terrorism must be kept in proper perspective. Disaster preparedness plans must maintain readiness for these events as well as the terrorist use of conventional explosives.[77,78] Accidental HAZMAT exposures remain even more likely. Robust, effective HCF preparedness integrated with local community planning will help address the more conventional threats.

Disclaimer: The opinions and findings in this article are those of the authors and should not be construed as official policies or positions of the US Department of the Army, US Department of the Air Force, US Public Health Service, or US government.

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The Role of Informatics in Preparedness for Bioterrorism and Disaster

Brief Review ■

The Informatics Response in Disaster, Terrorism, and War

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ABSTRACT The United States currently faces several new, concurrent large-scale health crises as a result of terrorist activity. In particular, three major health issues have risen sharply in urgency and public consciousness—bioterrorism, the threat of widespread delivery of agents of illness; mass disasters, local events that produce large numbers of casualties and overwhelm the usual capacity of health care delivery systems; and the delivery of optimal health care to remote military field sites. Each of these health issues carries large demands for the collection, analysis, coordination, and distribution of health information. The authors present overviews of these areas and discuss ongoing work efforts of experts in each.

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The United States currently faces several new, concurrent large-scale health crises as a result of terrorist activity. These crises are both real and potential, both known and unknown in their direction and magnitude. Each one carries large demands for the collection, analysis, coordination, and distribution of health information. The need for applied informatics expertise may be more pressing, and more in the public eye, than ever before.

In particular, three major health threats have risen sharply in urgency and public consciousness:

- *Bioterrorism*—the threat of widespread delivery of anthrax, smallpox, and other agents of illness.

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Optimal response to bioterrorist threats requires continuous surveillance with the collection of multifactorial data; coordination and standards to combine data coming from many hospitals and agencies; analysis and logic to detect unusual, statistically significant patterns from highly specific and less-specific indicators; and reliable, centralized sources of current diagnostic and therapeutic information.

- *Mass disasters*—local events that produce thousands of casualties, often overwhelming the usual capacity of health care delivery systems. In disasters, it is imperative to manage and dispatch resources to avoid bottlenecks, increase capacity through the temporary use of additional services, reduce idle time through precise advance communication, and track both patients and supplies.
- *Remote military operations*—problems of preventing and treating illness and injury among soldiers in remote, inaccessible regions, thousands of miles from appropriate medical expertise. Field health care can be improved by appropriate communication from the field to local medical corps and base hospitals, secure access to patient data from central data banks, and telemedicine techniques that allow a centrally located expert to provide service to multiple field locations.

Without question, there is a critical need for information management and communication in generating coordinated, effective action to prevent large-scale health problems and to respond to them when they arise. In this article, we present overviews of each area and discuss the ongoing efforts of experts who began working on these problems long before the current national crisis.*

Biosurveillance and Bio-agent Detection

The threat of bioterrorism is causing fundamental changes in the practice of both medicine and public health. Clinicians now must consider anthrax and smallpox in the differential diagnosis of acute febrile illness, and they must consider the consequences of their decisions to test, treat, or alert public health authorities with respect to the entire community as well as to the patient. More than ever before, clinicians must use, in their decision making, rapidly changing information about epidemiologic events and risk factors (e.g., level of exposure to mail and mail sorting). The effect on public health is arguably greatest in the area of public health surveillance, which is the ongoing systematic collection, analysis, and dissemination of data about disease. Public health surveillance must now occur in real time and utilize data that inherently become available much earlier than confirmed case reports or positive microbiology cultures.

Detection of a Bio-aerosol Threat

Biological warfare agents are often adapted for delivery in aerosol form, because they can simultaneously infect many persons by that route and because the air supply is much harder for military units to protect than the water or food supply. Anthrax, plague, tularemia, glanders, and smallpox are examples of organisms that can be delivered by this route.

Figure 1 illustrates the hypothetical effects of a large-scale bio-aerosol release of *Bacillus anthracis* on a suburban population. This figure is based on an economic analysis conducted by Kaufmann et al.[1] In this model, a population of 50,000 persons is exposed. The three curves show the time courses of onset of nonspecific symptoms, presentations to emergency departments with signs and symptoms sufficiently specific to *B. anthracis* (e.g., radiographic findings in the lung on plain films or computerized tomography, coupled with a compatible clinical picture) that presumptive treatment would be initiated, and deaths. The estimates for onset of symptom presentation and percentage mortality are based on the model of Kaufmann et al. and are also influenced by recent American data.[2]

The shaded area in the curve indicates the relatively brief window of opportunity for mitigation following anthrax release. Anthrax is most treatable early, ideally before symptoms become evident; this is the rationale for prophylactic antibiotic treatment. After day 8, treatment is unlikely to significantly reduce further morbidity and mortality. Therefore, both detection and response must occur within this narrow time frame. Generating a response (treatment and prophylaxis) for hundreds of thousands of persons requires time, so the window for detection is even narrower.

Figure 1 suggests several possible strategies to improve the promptness of detection. There are sev-

* The article is based on a panel presentation given at the 2001 AMIA Annual Symposium in Washington, DC, on Nov 5, 2001. The major contributor for each topic was Dr. Wagner, for biosurveillance and bio-agent detection; Brig. Gen. Schafer, requirements for event identification, signal-to-noise, capacity increase in disasters, and the LEADERS system; Dr. Mackenzie, coordination of field information, and telemedicine; and Dr. Teich, introduction, recommendations, and conclusions.

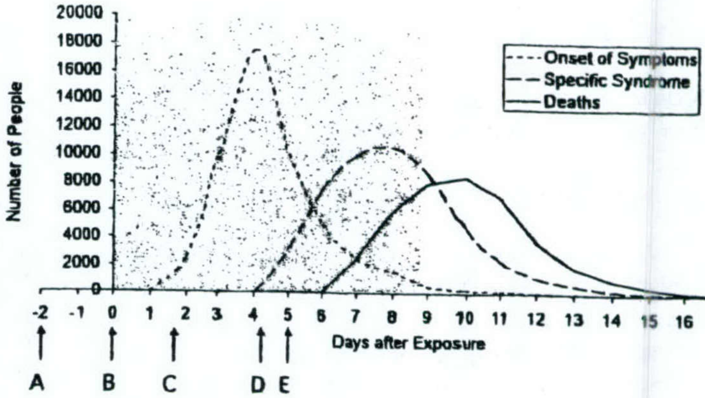

Figure 1 Epidemic curves and detection strategies for an outbreak of inhalational *Bacillus anthracis* due to a large bio-aerosol release. A indicates intelligence; B, biosensors; C, 500 prodromal presentations coupled with epidemiologic (e.g., work address) or intelligence data, or both; D, few cases with specific syndrome (e.g., x-rays, gram stains); E, culture-based diagnosis.

eral opportunities in this model for identification of the anthrax outbreak. Early identification could be based on a small number of patients with findings strongly suggestive or pathognomonic of anthrax infection, if the set of such patients happened to present to a single clinician or if the existence of all such cases could be known in real time by means of a detection and communication strategy.

An even earlier diagnosis could be based on the finding of an abnormally high number of patients with nonspecific symptoms that are consistent with anthrax infection. This detection method has lower specificity, since an unusual spike in presentations could derive from any of a number of agents. The detection of the spike, however, could prompt further investigation, such as probing for an epidemiologic association among the affected patients or providing increased, more specific testing of those patients. Like the previous method, this strategy would also be greatly enhanced by a real-time detection and communication system, especially one that includes epidemiologic data such as work address and home address, along with symptom data. This strategy is currently being pursued by many research groups; those projects are described in a separate paper in this issue.[3]

Figure 1 also shows that physiologic monitors and environmental biosensors that detect bacteria and viruses during the pre-infective and pre-symptomatic periods will eventually accomplish the earliest possible detection. However, such technology is currently expensive and uncommon. In the meantime, early detection of a surreptitious release will depend on monitoring people and animals for early effects of such a release and on detailed analysis of the epidemiologic characteristics of sick persons.

An ideal detector is timely, sensitive, and specific. Each practical strategy involves tradeoffs among these qualities. Therefore, a strategy that we and others are using is to couple a very early nonspecific detector with a second-stage detector that can achieve appropriate specificity. In the first stage, we are especially interested in methods that use brute-force computer searching to reveal anomalies in the data relative to historical trends. A comprehensive framework for other possible strategies is described elsewhere.[4]

Early Warning Through Integrated Regional Data

The detection strategies described above are much more effective if the necessary data are widely available over a large geographic region and can be integrated into an effective bioterrorism detection system. Several regions are testing such integrated systems; some of these are described by Lober et al.[3] in this issue of the Journal. In the RODS (Real-time Outbreak and Disease Surveillance) test bed in western Pennsylvania, involving real-time data feeds from 17 hospitals, we have been able to demonstrate early detection through integrated data.

We found that case detection, even if it is relatively inaccurate, is an element in epidemic detection. We conducted an experiment in detecting an outbreak of respiratory illness using ICD-9-coded chief complaints from emergency department visits as the only data source. We determined that we could detect acute respiratory illness (5 days or less) not accounted for by a nonrespiratory diagnosis with a sensitivity of 44 percent and a specificity of 97 percent.[5] A companion experiment to identify an influenza outbreak sounded the alarm 1 week earlier than the pneumonia- and influenza-death-based gold standard. Using the cross-correlation function, we showed that the data obtained from emergency department visits were inherently available 2 weeks earlier than pneumonia and influenza mortality data.[6]

Although these findings are more relevant to detection of outbreaks of food-borne illness than of inhalational anthrax, we also demonstrated a 6-day reduction in time lag for documenting reportable diseases.[7]

Architecture for Community Detection

We have also shown that it is feasible to obtain and integrate data of several types from different hospitals and health systems, including patient demographics, test orders, microbiology results, encounter notes, and other data obtained from electronic medical records. To date, every health system that we have approached has an emergency department computerized registration system that captures reasons for visits in real time and can provide these data to our central system through an HL7 outbound interface. Using these data alone, we can track viral symptoms, respiratory symptoms, diarrhea, rash, and encephalitis. The hospitals have been willing to share de-identified data in the interest of mutual assistance. To ensure that data from the regional early warning system can be aggregated as needed to provide statewide or national surveillance, we have committed to adherence to the standards promulgated by the National Electronic Disease Surveillance System (NEDSS).

Clinical Decision Support for Single-case Detection

The problem of detecting a single case of an extremely rare disease, such as anthrax, early enough to help the patient is a challenge that is fundamentally changing medical care. By the time such a case progresses to a pathognomonic or even relatively specific presentation, the case mortality rate will be high. Thus, early treatment, even with an uncertain diagnosis, is a goal. The field of medical informatics has very good computational models and methods for assisting physicians with the diagnosis and management of single cases. These methods have been under continuous development since publication of the seminal paper by Ledley and Lusted in 1959.[8]

Using a Bayesian model of inhalational anthrax, for example, we can easily model the relationship between the disease, its findings, and risk factors such as postal work. We can even establish parameters for the model using recently available anthrax case data.[2] However, the prior probability of inhalational anthrax is so low that no finding or test, other than a definitive culture, has a positive likelihood ratio sufficiently high to move the posterior probability of an anthrax diagnosis above any decision threshold. This suggests that current diagnostic and treatment decision-making approaches must be expanded to include additional information or knowledge. Such information might include information about the health of other individuals in the population or about contaminations in specific locations. Although physicians unassisted by computer systems are capable of making such inferences, their ability to stay abreast of rapidly changing population-based risk data is very limited.

There are, of course, many pathogens besides anthrax, and an almost unlimited number of methods for dissemination, so it is not certain that lessons learned from these examples can be generalized to all situations. In a separate report, we discuss a clustering of known threats into ten categories, which reduces the analytic complexity without loss of generalizability.[9] On the basis of our work with that set of threats, we think that the basic strategies for early detection outlined here also hold for the broader set of threats.

Requirements for Event Identification

No one expected the ramifications of the events of September 11. Other episodes of bioterrorism occurred even before that, however, such as the deliberate contamination of salad bars in Oregon with salmonella. There have also been bio-epidemics unrelated to deliberate terrorist acts, including outbreaks of hoof-and-mouth disease and West Nile virus. In all these cases, deliberate or not, we have faced the same problem of how to detect and track the illnesses.

Informatics unquestionably plays a significant role in this effort. However, in the weeks since October 4, when the first case of anthrax was detected in the 2001 episode, we saw that our national capabilities needed to be enhanced to be useful. We were able to handle some of the consequences of this incident, but we did not have pre-emptive surveillance in place to detect and track the incident in its earliest phases. We have now recognized the need for greater collaboration and data integration among hospitals. There are good systems in Pennsylvania, in Denver, and in other areas. But in most parts of the country, such systems do not yet exist.

Our job here is to detect and identify a significant event, specifically, the introduction of a biological agent into a community. Surveillance is a must, and it needs to occur in real time. Several key data elements need to be collected, which can be found in

many different parts of the community. The data set includes elements typically found in an electronic medical record, such as symptoms, chief complaints, and laboratory results. It also includes dispensing patterns from pharmacies, epizootic information from veterinarians, postmortem findings from morgues, and school- and work-absence data. All these data have to be temporally correlated, and the reporting must be mandatory; voluntary reporting inevitably leads to diminished data.

As discussed earlier, sensors with high specificity and sensitivity greatly facilitate detection. Pathogen identification is where we need to start using some of the newer techniques that are available, such as polymerase chain reaction and, eventually, biochips, which can detect the DNA sequences of a number of biological agents. These devices need to automatically report to our surveillance networks to be effective. All the armed services sent biological assessment teams with polymerase chain reaction tools to New York City and Washington during the 2001 anthrax incident.

The LEADERS System

Surveillance is exceptionally complex; one attempt to solve this complexity is a program called LEADERS (Lightweight Epidemiology Advanced Detection and Emergency Response System). This system includes several modules that provide key information services for biosurveillance—data entry, data distribution, algorithms to analyze the data, knowledge distribution, and command and control.

LEADERS is designed as a continuous surveillance system. It can collect symptom complexes, link them to laboratory data and other major information sources, and generate local epidemiology reports as well as provide centralized global information.

Laboratory tests are the key to and, in many cases, the gold standard for, definitive diagnosis. Polymerase chain reaction findings move the diagnosis timeline to the left more effectively than laboratory cultures do. Gram stains may be the fastest way to generate a diagnosis, with polymerase chain reaction slightly slower but more definitive. In all cases, the output of these sensors should be in a standard electronic form that can be integrated with other information sources.

Signal-to-Noise Ratio

We can use the techniques of the signal processing field to tease out a rare but specific bioterrorist incident (signal) from a sea of routine health events (noise). The "noise" is the baseline of other events that will be picked up by the sensors—for example, an influenza epidemic will increase the overall number of respiratory illnesses and may obscure cases of anthrax, which may present with indistinguishable symptoms. The "signal" is the data that indicate an anthrax release. This also points up an additional value of influenza vaccination: If we can reduce the number of patients who get influenza, we can also improve our detection by reducing noise. In other words, an outbreak of respiratory symptoms would be more suggestive of anthrax if we were confident that a flu outbreak was not occurring.

More-specific data produce a greater signal for each observation, so we do not need so many specific observations to get a good signal. Less-specific data have a lower signal or may even be part of the noise. Refinements in biosensors may yield new, specific data that carry a high signal value. Sometimes the best we can do is screen, to detect a possible event sensitively, without much specificity. Then we can analyze the data block in detail, analyzing more detailed data that can improve the signal-to-noise ratio.

Increasing Efficiency in Disaster Response

Coordination of Information from Field to Hospital

The integration of medicine, technology, and human factors is critical to the successful application of informatics to disaster medicine and other emergencies. The Human Factors Research Program (http://www.hfrp.umm.edu) at the University of Maryland is testing several applications of technology during simulated disasters in the Maryland Emergency Medical System, and in real life at the University of Maryland Shock Trauma Center and Medical System. Such enhanced telecommunication for emergency medical care is important for future military and civilian applications, both in disaster management and in response to bioterrorist attacks with weapons of mass destruction.

Voice communication is currently available through a microwave network covering 97 percent of the surface area of the State of Maryland. This communication network enables pre-hospital field care providers to communicate directly with physicians in trauma centers (known as the Trauma Line) and other referral centers. The Trauma Line information is abstracted and put on a white-board. The recorded data include vital signs of the patient, estimated time

of arrival, means of transport (helicopter or ground transportation), mechanism of injury, level of consciousness, and priority status (1 = severe). The trauma team obtains the summary information from the white-board after a group-page alerts them to the patient's estimated time of arrival.

This system is relatively inefficient, because the whole trauma team responds to each admission. The voice data may omit useful information because the field care provider is performing under stress in difficult circumstances. Variations in what is reported can lead to gaps in information. There may be a lack of information about a patient, but there may also be a lack of communication of the available information. Reports confirm that observations at the injury scene are communicated only 75 percent of the time, and additional information is helpful in 52 percent of cases.[10] A review of voice communications from the field showed that the receiving team rarely asked questions. The pre-hospital person also spent a lot of time waiting to find the right recipient for their information. In a typical example, 205 of 385 seconds of a communication were spent "on hold." In disasters in which multiple ambulances and field units are reporting to multiple hospitals, this kind of delay and lack of communication of available information is unacceptable, and an improved and automated system of information transfer is needed.

We sought to improve this process by the use of a fax "notepad" linked to a cell phone in an ambulance, to send information before a patient's arrival. We compared such admissions with conventional admissions that lacked this information. We found that, at 15 minutes after admission, the trauma team achieved more of the landmarks in advanced trauma life support when patient information had been faxed ahead.

The next enhancement that we are testing is global positioning transponder system on ambulances for cardiac transport. The fully automated system transmits the current location of an ambulance to an ambulance coordination center, where it is displayed on a map of the state. This facilitates appropriate and efficient dispatch of ambulance units. The system also pages the team in the cardiac catheterization laboratory. As the ambulance approaches the hospital, it passes through three zones of activation, and the team is paged 20 min, 10 min, and 5 min before its predicted arrival (based on location), so that they can coordinate their activities with the arrival. Other parts of the system allow a physician at the hospital to look at electrocardiogram and vital sign waveforms transmitted from the ambulance.

In disaster situations, the information provided by such a system could help emergency teams anticipate the workload for an incoming patient, prepare early intervention before a patient's arrival, and get a better sense of the flow of multiple patient arrivals.

Rapid Acquisition of Multi-patient Information from a Disaster Site

Another project, known as "MobiDoc," makes use of next-generation wireless technology to create an entirely mobile telecommunication system. This communication kit, which is the size of a briefcase, contains eight cell phones and wireless data-acquisition devices that are connected to the cell phones. A field team can perform multiple charting, vital-signs monitoring, image collection, and other data acquisition tasks for multiple patients; the data are sent securely to the hospital's intranet, where they can be viewed on a Web browser by control personnel. We are currently able to transmit up to five images a second through this system.

All these systems allow more patient data and arrival information to be communicated to a hospital or disaster control center. The systems need to be coupled with intelligent algorithms to make use of the data to balance resources, e.g., to make sure that patients who need CT scans are equally distributed among the hospitals that can provide them. Furthermore, while these systems allow us to make more efficient use of existing resources, we also need to find ways to temporarily increase capacity in a local area when disaster strikes.

Increasing Capacity

In June 2001, Tropical Storm Allison, the "rain of terror," caused huge flooding in Houston. Emergency departments already working to capacity had to face great increases in patient volumes. In addition, the generator of one large hospital was flooded and the entire hospital lost power, forcing closure of their emergency department and evacuation of all their patients. In a matter of hours, the system went from normal activity, which is already close to capacity, to extreme overload.

The Air Force placed a rapidly deployable mobile surgical hospital in Houston, which was able to handle about 1,000 patients. Although it did not meet the entire need, it took the peak overload off the other emergency rooms so that they could again manage their own patient workloads. These resources are available through the Federal Emergency Manage-

ment Agency (FEMA) and are dispatched on the basis of established entry and exit criteria.

Information Elements for Incident Management

The LEADERS system includes several modules—a dashboard for overall viewing and coordination of information; resource allocation modules to track ambulances, intensive care unit beds, burn treatment facilities, and other resources; emergency contact lists and automatic notification software; checklist managers to maintain guidelines for hazardous material and other key procedures; and casualty tracking. These are the critical elements of incident management software.

Such software should be deployable for use by local and regional emergency management agencies as well as by FEMA and other national agencies. The LEADERS system is built on an application service provider model, so that with appropriate permissions, the system can be accessed for use by a variety of agencies.

Tele-presence

Tele-diagnosis

The third major problem area is the provision of expert assistance to remote medical caregivers in military operations. Through telemedicine technologies, it may be possible to have an expert in one location directing, and using, the eyes and hands of field personnel. A specialist at a single base station could then provide assistance to many frontline units concurrently.

We have been looking at a task model for acute stroke, using transportation time (the time for a patient to be transported to the hospital) as part of the diagnostic time. In stroke, time to diagnosis is critical because the window for thrombolytic treatment is so small.

Using telemedicine technology, a neurologist in the hospital can complete a National Institutes of Health stroke scale examination in 8 minutes, while the patient is transported to a hospital. If the neurologist concludes that the patient is probably having an acute stroke, the patient is not taken to the emergency department at all, but straight to the CT scanner. Our aim is to reduce arrival time at the scanner by 30 minutes, compared with the time it takes when pre-hospital telemedicine assessments are not used. We have seen successful reversal of strokes with this system that may not have been possible otherwise.[11] This model for remote diagnosis can be applied to complicated injuries and medical syndromes in military operations at any distance.

Telemedicine inputs can be provided from the home, the clinic, primary hospitals, and ambulances into a single control area in a tertiary trauma center. Once received, the information can be transmitted through an intranet to any desktop in the institution. Physicians inside the hospital can thus coordinate their activities from several locations, such as radiology and operating rooms.

Tele-presence for Procedures

Another side of the telemedicine coin is remote guidance of procedures. We looked at tele-supervision of emergency airway management of a trauma patient. The procedure was guided by a task communication algorithm that specified for field personnel how to look at the chest, when to listen to breath sounds on the left or the right, when to check carbon dioxide monitors, and so on. In an experiment, we used this tool to provide airway management tele-consultation, or tele-mentoring, to a group of trainees who were intubating human beings for the first time. One group used conventional equipment. The other group used the above algorithm with a head camera and a communication system that brought the mentor into the process. The group with the tele-mentor took a little longer to insert the tube properly. This is probably because the mentor needed more time to get oriented, a matter of 1 to 2 seconds.

In another project, funded by the Army Research Institute, we are looking at the remote management of trauma cases, which perhaps bears a more direct relationship to military operations. In this experiment, a trauma surgeon in a tele-control center directs the activities of the trauma team, which is "remotely" situated 50 to 100 feet away but out of direct sight and hearing of the trauma surgeon. Equipment includes a wireless headset for communication with the team leader, a wireless video head camera that transmits images from the wearer, a pan tilt-and-zoom camera, and an overview camera.

We compared the trauma evaluation and management process in this set-up to that of a similar case in which the trauma surgeon was on the scene. When remote, the surgeon asked more questions (72 vs. 60 percent of communications) and gave fewer instructions (28 vs. 40 percent) than when on site. These data suggest that the remote surgeon was not so sure about what was going on and possibly not so confident about giving instructions. The system is, nonetheless, better than having no trauma surgeon present at all, although it needs improvement to be as good as direct presence.

Recommendations

The recent terrorist incidents in the United States should be taken as a "call to arms" to medical informaticians. As discussed in this article, informatics has a prominent role to play in the prevention and management of terrorist attacks of many kinds.

Coordination of information among local, regional, and national agencies needs to be much better. Several policy changes may be needed to accomplish this, including:

- Greater deployment of biosurveillance systems in more regions of the country, possibly through application service provider models or other rapid-deployment techniques
- Support for research that leads to optimal algorithms for evaluating early symptom and epidemiologic data, to better identify bioterrorist attacks
- Consolidated sources of reliable education for medical providers and for the public, about the current status of any biologic incident and the best steps to take in response to it
- Coordination of efforts in disaster preparation and acute disaster management
- Education in appropriate application of enhanced telecommunication technologies
- Fewer barriers to the exchange of de-identified public health information among health systems, with appropriate confidentiality protections
- Policies for rapid, urgent deployment of increased resources in disasters
- Reimbursable billing for screening diagnostics
- Adoption of standards for data exchange, and a standard data collection set such as NEDSS.

Conclusions

There are many critical roles for superior information management in the detection, prevention, and management of disasters. Many of these roles have been explored at a few research centers. We have shown that existing systems can improve early detection of bioterrorist agents, can improve the management of large-scale disasters, and can deliver medical expertise to remote field sites.

For a reliable, efficient, immediate (and sometimes pre-emptive) response, optimal techniques must be established and deployed over all target regions. Centralized services for information and centralized clearinghouses for data must also be established, to maximize the available data for surveillance and to allow rare resources and expensive reserve capacity to be applied over many sites. Government and payer support is needed to promote data exchange standards, to support research, and to make surveillance economically feasible.

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Terrorism Preparedness Training for Nonclinical Hospital Workers: Empowering Them to Take Action

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While aspects of the national response to the last years' terrorist attacks have included preparedness training for health care institutions, much of the focus has been on clinician recognition of biologic exposures. However, many hospital workers have nonclinical responsibilities (such as housekeepers and mailroom workers) and many more, though active in clinical care, are para-professionals with limited medical training (such as nursing assistants). These workers are critical to the achievement of our institution's mission to provide competent and compassionate medical care, even during an emergency. In recognition of this, and to understand their attitudes and concerns, we conducted focus groups. The process provided a forum to receive immediate feedback from the workers, and will be used to design customized knowledge and skills training sessions that empower them to take proper responsive action should a terrorist attack occur. Our experience may be useful to others who are planning terrorism preparedness training programs. (J Occup Environ Med. *2003;45:333–337*)

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Last year's terrorist attacks and subsequent anthrax threats made us more aware of the possible risks to and the training needs of our hospital staff, including nonclinical workers. Challenged to craft training for these workers, we employed a Risk Communication model.

Risk Communication involves an exchange of information, concerns, and opinions among individuals, groups and institutions concerning a risk or threat to human health or the environment.[1] Although Risk Communication is a relatively new area of scientific study, several principles have been established: (1) know the hazard (for example, the exposure mechanisms, potential harm, and scientific uncertainty), (2) know your audience (including their pre-existing attitudes, and their interactions with coworkers and others to whom they might turn to for information), and (3) know your audience's communication preferences regarding the **message** (the content information about the risk), **source** (person giving the information), and the **channel** (eg, written or verbal messages) that best suits their needs.[2,3]

The process through which information about the audience and their preferences is gathered is termed a focus group. First used in the business world but readily adaptable to public health, a focus group is a meeting in which an experienced communication expert: (1) 'focuses' and probes stakeholders (audience) for their attitudes and opinions, (2) uses a predetermined set of questions

TABLE 1

Focus Group Topics

1. Current individual and co-workers' perceptions of risk of a terrorism event,
2. Families' perceptions of risks,
3. Possible impact on their work, including specific situations and perceived constraints (training, equipment, staffing, etc.),
4. Preferred training topics,
5. Preferred format and methods of training,
6. Evaluation of current terrorist preparedness training, and
7. Who they turn to at work for support.

to avoid influencing audience members, (3) allows participants to verbalize their emotions, and (4) records responses which otherwise might be dismissed as being based on misperceptions or seem peripheral to the situation.

Empowering Nonclinical Hospital Workers

Peter Sandman, a well-known Risk Communication expert, has popularized the formula: "Risk = Hazard + Outrage."[4] This implies that a presentation of facts (hazards) alone will not necessarily give the stakeholder audience the information it wants and individuals may not even comprehend factual information until their feelings, concerns and fears (their outrage) have been addressed. This is likely to be particularly applicable to the risk of a terrorist attack in which we dread an imposed act, an artificial and perhaps undetectable exotic biological, chemical or radioactive agent, a deadly explosion, or other hazard for which we might have less scientific or medical information. Afterall, the motive of a terrorist attack is often not only to cause physical harm to some of the targeted population, but also to invoke fear and cause disruption in the larger population.

Research has also demonstrated that different ways of presenting the same risk information can lead to different evaluations of the situation and different decisions about how to manage it.[5] In addition, when exposed to a large number of risk messages simultaneously, the audience might reach a saturation point and stop listening.[6]

Carolyn Needleman, another expert in Risk Communication, states that for dissemination of information to be effective, it must lead to an action response by those who are at risk. If the end result is not measured by such a change in behavior, then the Risk Communication intervention becomes a kind of ritualistic activity only, in which a presentation of scientific or medical information is imposed upon an audience without empowering them to manage it. Feeling unable to manage a terrorist attack, workers might over-react (eg, refusing to open any mail for fear of anthrax). On the other hand, if they feel helpless and hopeless they might under-react and they fail to apply knowledge from their prior training or use available protective equipment. They might also be too anxious or apathetic to learn new messages that describe an evolving high-risk situation and how to manage it. To avoid such 'ritualism' in Risk Communication, she suggests that: (1) messages be personalized enough to provide a framework for individual action, (2) important messages be repeated by using a wide variety of media, organizational vehicles, and authorities, (3) messages be reinforced by supportive social networks for those at risk (such as coworkers, families, and others), and (4) messages should address the audience's feeling of 'powerlessness' and provide individuals with clear advice on actions they can take, even in a high-risk situation.[6]

The unaddressed questions and fears of nonclinical para-professional hospital workers could threaten the achievement of a hospital's mission through several avenues including: (1) high absentee rates during a terrorist event as workers question whether they want to put themselves in harm's way[7] (eg, postal workers during last autumn's anthrax scares); (2) increased staff turnover in light of uncertainty about job safety or concern with their workplace itself being either a target or a gathering site for contaminated or infected victims; and (3) perceived inequities in health protection such as the distribution of vaccinations or antibiotic prophylaxis. Any of these factors could result in staffing shortages that might cause an institution to close its doors. Such over-reactions and under-reactions might be mitigated by informative and supportive measures that teach workers to take action to lessen the risk to themselves, their coworkers, their patients, and their families.

Methods

The authors designed and conducted focus groups of representative hospital workers within the Department of Veterans' Affairs Maryland Health Care System (VAMHCS), based on elements of risk communication methodology described above and cited in the literature.[2–5] The focus group topics considered the nature of the hazard(s), the person (audience), the social environment, and the participants' communication preferences, as displayed in Table 1.

The focus groups included workers with and without patient contact and comprised the following: Police Security Personnel, Medical Assistants, Housekeepers, Food Service

TABLE 2
Focus Group Questions—Terrorism Preparedness Training

Question Number	Question
1.0	I would like for each of you to tell me how people at work are feeling about the possibility of a bioterrorism event that would affect the hospital in some way. (Go around the room and ask each person to share his/her thoughts.)
1.1	Do most of the people you know feel this way?
2.0	Now, I would like to ask each of you about your own concerns about a bioterrorism event. What have you been thinking and feeling?
2.1 probe	Are there particular things that you worry about?
2.2 probe	How about your family? How do they feel about your work here?
3.0	If there were a bioterrorism event in the area, how would it affect the way you do your work?
3.1 probe	Would it affect the types of things you would do?
3.2 probe	Would it affect how you feel about your work?
3.3 probe	Would it affect the way you act toward patients?
4.0	As you know, we are trying to help the hospital develop a training program about responding to bioterrorism events—what are the things that you would like to know about? I'd like to write these on the board so that we can keep track.
4.1 probe	Keep probing until there are no more answers
4.2 probe	Now, I'd like for each of you to tell me the most important things you would like to know about.
4.3 probe	Are there particular things that you feel you need to know so that you will be able to perform your work during an event?
5.0	How would you rate the information that you have received so far?
5.1	How could it be improved/changed?
6.0	People prefer different ways of getting important information. How would you like to have information on bioterrorist events presented to you?
6.1 probe	What do you like about that method?
6.2 probe	Who would you like to have give you this information?
6.3 probe	Why would you like information from that person?
6.4 probe	In a time of crisis, to whom would you turn to at work for support?
7.0	Wrap up: Are there any other suggestions you would like to make about the training program?

Workers, Fire Fighters, Engineers, Laundry Workers, Mailroom Workers, Chaplains, and other nonprofessional staff. Refer to Table 2 for focus group questions. The sessions were audio taped and then transcribed without identifying the participants.

Results

Focus groups' participants expressed enthusiasm for the process generally and for the institution's desire to address worker concerns in subsequent training sessions. Illustrative examples of various concerns and subjective responses of focus group members described in the literature were elicited in our sessions. These included examples of *overreaction* to the bioterrorism threat such as 'there was a moldy coffee cup left in the restroom and nobody from housekeeping would even touch it'; or 'I wouldn't come to work; there is no amount of pay that is worth your life'. Contrarily, there were clear examples of *underreaction* such as 'nobody is worried about it at all; we wouldn't see it in our hospital'. Also observed among the nonempowered were examples of resignation and helplessness such as 'there is a lot of melancholy and depression right now'; or 'when it's your time to go, you're going to go anyway'.

The focus groups' responses to training preferences are displayed in Table 3 according to the **message** (ie, information the workers requested), **source** (who they suggest should communicate the information), and **channel** (the teaching method preferred). There was a consensus that: (1) regarding the message, most workers want some basic information on various hazards which terrorists might use, but this information should be less detailed than the published materials previously made available to them, and should focus on the early recognition of attacks and the equipment and procedures to protect themselves, their coworkers and patients; (2) regarding the source, experienced military personnel and scientists should deliver this information; and (3) regarding the channel, they want detailed role-specific training sessions that are ultimately tested by drills (simulated terrorist attacks).

Discussion and Next Steps

Stakeholder participation through our focus groups demonstrates that hospital workers are fearful of terrorist attacks and feel unprepared to assume their possible work roles. Rather than a monologue in which a speaker provides 'generic' information on hazards, they want information and training tailored specifically for them. The expertise of the

TABLE 3
Focus Group Summary

Focus Group Composition	Message	Source	Channel
Patient contact: Medical Assistants, Union Representative (*n* = 6)	Hospital security plans, Evacuation, PPE, Patient transport, Isolation rooms, & How to report unusual situations	Military personnel, Hospital staff (including nurse managers), Hospital management, & Expert to be a continuous resource for updated info	Small group sessions, DSD drills, Take-home info, On-going mixed discussions (multi-staff), Regular updates, & CBA
Patient contact: Chaplains (*n* = 7)	Info on terrorist agents, Handling suspicious packages, & Chaplains' role in providing support for anxious employees	Scientist from nationally recognized health organization (CDC, NIH), & Hospital management	Inter-departmental discussion groups, & Drills
No patient contact: Police/Security Personnel (*n* = 5)	PPE, Protocol for investigation of pathogen source, & COC	Military personnel with knowledge of agents along with Chief, Police/Security	Large lecture format for Police Officers only, & Drills
No patient contact: Housekeepers, Food Service Workers (*n* = 6)	PPE, & Updated Disaster Plan	Military personnel, & Knowledgeable supervisor or department head	General knowledge training & then role-specific training according to a predetermined hierarchy of who needs to be trained first, Small group interactive sessions with Q&A period. Frequent DSD, & CBA
No patient contact: Biomedical Engineers, Engineer, Carpenters (*n* = 4)	Update Disaster Plan and Department-specific plan, Handling airborne & waterborne threats (e.g. shutdown of air handlers), COC, Timely notification of staff in emergency situation, & Clarify role in city-wide emergency	Safety Officer, CDC-scientist who is able to speak to all levels of staff	Easy to read policies & procedures, Methods which make training available to those unable to attend initial session (e.g., videos), Hand-on training, & Drills
No patient contact: Firefighters, Biomedical Engineers, Grounds Maintenance Workers (*n* = 6)	Info on agents (e.g. identification of and modes of delivery), Procedures for each agent (e.g. PPE) as "rescuers may become victims", COC, Timely notification, & Role of fire fighters/HAZMAT versus police when there is a suspicious package	Military personnel with experience in preparing for terrorist attacks, Send staff to military facilities for training, Workers' input in policy-making, & Expert to be a continuous resource for updated info	Rapid training for all, Frequent updates, Specialized hands-on training for police officers, fire fighters, & Role-specific training for others involved
No patient contact: Laundry Workers, Medical Supply Workers, Mailroom Workers, Union Representative (*n* = 8)	Info on agents (e.g. identification of), COC, A recent mailroom anthrax scare showed "a lack of clear policy & training", Police officers need more in-depth training, & Plan so that an emergency does not disrupt patient care	External experts, & Internal authorities	Communication and worker feedback from the trenches, shows leadership, Inconsistent info leads people to search for their own sources, Too-detailed info from internet is discarded, Clear, written guidelines, Drills, "Round robin", military-style workshops with stations (e.g. PPE), Role- and Department-specific training, Info cards, & Videos

Key PPE = Personal Protective Equipment (e.g. respirators), COC = Chain of Command (i.e. who to call if supervisor is not available, or during non-administrative hours), DSD = Department-specific drill, CBA = Computer-based application.

speaker and the method in which the information is delivered are also important.

The moral rationale for Risk Communication is to empower those at risk to make informed decisions, reducing involuntary hazardous exposures, saving lives, preventing disease, and encouraging early medical treatment where needed.[6] To empower workers, including the over-reactors, under-reactors, and the resigned, we next plan to design a terrorism preparedness knowledge and skills training program for non-

clinical para-professional hospital workers that considers the:

1. Message: We will provide necessary medical and technical information related to potential biologic, chemical, radioactive and explosive hazards, but at a level that considers the workers' educational level, job description, and anticipated role in the event of a disaster. Specifically, we focus on providing information on specific terrorist hazards that will include early recognition of outbreaks according to syndrome-based criteria (ie, usual symptoms; and initial treatment considerations that workers *themselves* can begin to mitigate the hazard, such as clothing removal and showering), infection control (ie, isolation procedures, quarantine and evacuation criteria, patient transport, decontamination and proper cleaning, and personal protective equipment that can be effectively used so that workers can safely come to work or stay at work), security plans, clear chain of command (ie, who to listen to, and who to report to), evacuation plans, and psychological effects of terrorism.
2. Source: We will use outside experts (eg, military personnel with experience in biological and chemical terrorism) and internal experts in hospital management, safety, education, infection control, and environmental health. We will provide access to a helpline for up-to-date information; and
3. Channel: We will implement the various training methods suggested in the focus groups (ie, printed material, lecture, small group discussion, and video).

We will pilot test the program to refine the methods of presentation, logistics of the training (eg, schedule disruptions), and the readability of materials. Pre- and post-training evaluations of the workers' knowledge and beliefs, and changes in the their attitudes toward preparedness will also be assessed. Ultimately, the training will be tested in a comprehensive hospital disaster drill of a simulated terrorist attack.

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REVIEW ARTICLE

Chemical and biological weapons. Implications for anaesthesia and intensive care†

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In the wake of recent atrocities there has been renewed apprehension regarding the possibility of chemical and biological weapon (CBW) deployment by terrorists. Despite various international agreements that proscribe their use, certain states continue to develop chemical and biological weapons of mass destruction. Of greater concern, recent historical examples support the prospect that state-independent organizations have the capability to produce such weapons. Indeed, the deliberate deployment of anthrax has claimed several lives in the USA since September 11, 2001. In the event of a significant CBW attack, medical services would be stretched. However, victim survival may be improved by the prompt, coordinated response of military and civil authorities, in conjunction with appropriate medical care. In comparison with most other specialties, anaesthetists have the professional academic background in physiology and pharmacology to be able to understand the nature of the injuries caused by CBWs. Anaesthetists, therefore, play a vital role both in the initial resuscitation of casualties and in their continued treatment in an intensive care setting. This article assesses the current risk of CBW deployment by terrorists, considers factors which would affect the severity of an attack, and discusses the pathophysiology of those CBWs most likely to be used. The specific roles of the anaesthetist and intensivist in treatment are highlighted.

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'Armis bella non venenis geri' (War is waged with weapons, not with poison). Roman adage.

The devastating attacks on Washington and New York on Tuesday, September 11, 2001 focused worldwide attention on the potential consequences of a successful terrorist attack. The international media fanned speculation concerning the possible use of both chemical and biological weapons by terrorists. The political response to the September 11th atrocities (particularly in Europe and the USA) included reviews of civil defence policies to refine protocols for the management of the effects of chemical and biological weapon (CBW) use by terrorists. In addition to the reassessment of logistical capabilities, specific aspects of medical management were re-evaluated.

Weapons of mass injury need not be very sophisticated to be devastatingly effective, as was demonstrated in New York. The terrorist destruction of chemical plants or nuclear power stations, for example, would undoubtedly result in significant death tolls, both immediately and over the longer term. However, there is evidence of more deliberate attempts by terrorist organizations to manufacture specific mass fatality weapons. United Nations inspections of Iraqi military establishments after victory in the Gulf War revealed biological, chemical and nascent nuclear weapon capabilities. The militant fervency of anti-West extremism amongst certain Middle Eastern religious and political groups (assisted by covert state support), particularly in the wake of recent events, has increased the possibility of high-fatality terrorist attacks. Deliberate release of anthrax spores, using the postal system as a delivery mechanism, has claimed several lives in Washington, USA.[17]

Before the attacks on the USA, standardized protocols had been developed to manage accidental releases of hazardous materials (HAZMAT)[5 52 83] (indeed, accidental spillage of hazardous materials remains far more of a threat

† This article is accompanied by Editorial I.

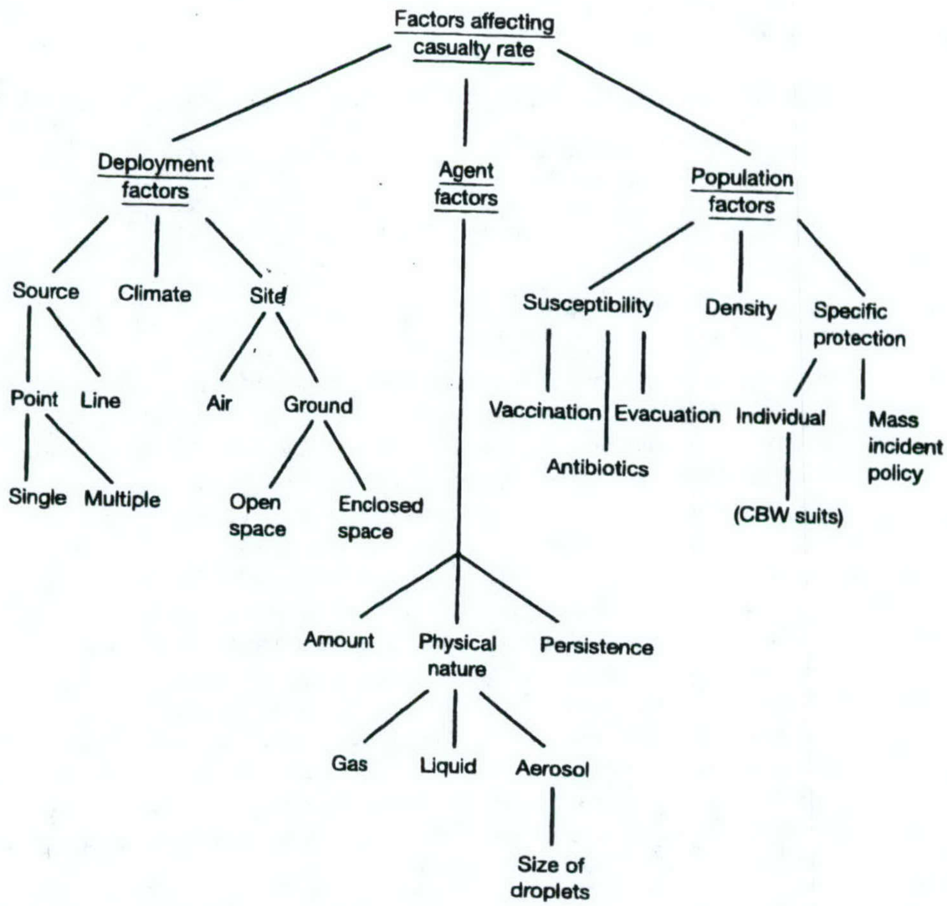

Fig 1 Factors affecting casualty rates after the use of chemical and biological weapons.

to public health than release by terrorists).[84] After an attack with a CBW, the number of casualties may be significant, as a result of injuries caused by both the agents themselves and coincidental trauma. The medical services would inevitably be amongst front-line responders,[50] placing medical supplies, personnel and facilities under strain. The efficacy of the medical response could be improved if health-care professionals were better aware of the symptoms, pathophysiology and treatment of illnesses caused by the agents most likely to be used.[118] Such information may be obtained from a number of sources.[22 29 41]

This article contains a distilled version of the advice available for treating mass exposure to CBWs, concentrating specifically on poisoning and infections, which are likely to be encountered by anaesthetists in their capacities as emergency or intensive care physicians.

Factors affecting the severity of CBW attacks

There is increasing feeling amongst hospital clinicians that there should be more concern about the treatment of casualties after terrorist attack using CBWs.[35 110 112] The threat of CBW use by hostile organizations did not disappear after the 1972 Biological Weapons Convention, the 1993 Chemical Weapons Convention or the United Nations Special Commission (UNSCOM) investigations in Iraq.[120]

An estimated 27 000 Iranian casualties were sustained as a result of CBW release by Iraq during the Iran–Iraq war (1984–1988), the agents used including mustard gas and tabun nerve agent.[100] Investigation of Iraqi military capabilities by the UN after the Gulf War revealed basic research and production capabilities for *Bacillus anthracis*, rotavirus, aflatoxin, botulinum toxins and mycotoxins.[43 119]

Of perhaps greater concern is the ability of non-governmental organizations, or even individuals, to manufacture CBWs. Police investigations into Aum Shinrikyo after it released sarin nerve gas in a Tokyo subway station in 1995 revealed that the cult had produced sarin and VX nerve gases, built three laboratories to culture *B. anthracis*, botulinum toxin and *Coxiella burnetti* and carried out nine biological weapon attacks between 1990 and 1993.[57] Such an instance shows that small groups or individuals are capable of manufacturing CBWs. Moreover, as recent events in the USA have proved, the operations of small units may be undetectable by government security departments.

The severity of a terrorist CBW attack depends in part on the dispersal method used. CBW release into water supplies or food chains produces fewer casualties than occur after airborne release. However, it should be remembered that,

after an attack, food and water supplies may become contaminated as a secondary consequence, resulting in further casualties.

Deployment of CBWs by missile attack is feasible. 'Al Hussein' modifications of SCUD missiles, which had been modified to carry both chemical and biological weapons, were discovered in Iraq by UNSCOM. Explosive deployment partially destroys the payload—the amount of an initial dose of biological agent that remains after the explosion is minimal, and chemical agents are degraded by the high temperatures that occur during ignition. However, fatalities may result from the explosion itself.

The most likely form of deployment is by airborne release of the agent as an aerosolized or powdered preparation.[97] Several hundred Italian-made pesticide dispersal systems were discovered by UNSCOM in Iraq, a few having been fitted to vehicles and aircraft. Powdered preparations have recently been used in the USA. The airborne route is not easily detectable and rapid dispersal over a large area is achievable.

Several factors influence casualty rates after an airborne attack.[42] These are summarized in Figure 1. Point deployment describes the release of agents from a single source. Line deployment occurs, for example, by release from a moving vehicle or aircraft; a wide cone of dispersal occurs if line deployment occurs perpendicular to the prevailing wind. In general, maximum casualties are obtained by line deployment of large amounts of gases or aerosols perpendicular to a gentle breeze upwind of a major, unprepared population centre.

Initial management of casualties

Whilst first-aid and logistical management are beyond the remit of this review, several principles of initial management apply to the hospital and intensive care management of those exposed to CBWs,[63 73] notably triage, decontamination and protection of hospital staff members.

Triage

Primary triage occurs at the site of the disaster. Secondary triage occurs when the patient arrives at hospital, and it allows determination of the best use of available resources.[118] Anaesthetists may be involved in primary or secondary triage, providing both treatment and a realistic assessment of the survivability of patients' injuries. Patients are classified into four groups of treatment category: expectant (death inevitable); immediate (life-saving treatment required immediately); delayed (treatment can be delayed without interim harm); and minor (the 'walking wounded'). The triage status of patients may change between their primary and secondary assessments, consequent to developing pathophysiology (e.g. chemical pneumonitis).[4]

Decontamination

Decontamination describes the removal or neutralization of CBWs to limit human exposure.[19] This protects patients from further damage and health-care workers from injury (which maintains the efficacy of a treatment centre). Decontamination of extensive areas is impractical, but personal decontamination or small-scale decontamination may be instigated by dilution of CBWs (e.g. by showering) and the use of chemical agents (e.g. soap, hypochlorite solution). Decontamination in the ambulance reception area is ideal because this will minimize the exposure of hospital staff to contaminants.[109] Anaesthetists who are part of the primary response team should be trained in the use of Level C personal protective equipment, which includes a full-face mask or half-mask, air-purifying respirators, hooded chemical-resistant clothing (splash suit), chemical-resistant gloves (inner and outer) and boots (with outer covers).

Detection equipment is required to monitor levels of CBWs. Priority is given to life-saving treatment over decontamination. It is preferable for patients to decontaminate themselves. Clothes and jewellery should be removed and the patient washed from head to toe with soap and water, but gently enough to avoid skin trauma. Provision should be made for wound and eye irrigation, the use of drapes and barrier nursing, and the collection and disposal of fluids used for decontamination.[31] Specific decontamination measures are highlighted in Tables 1 and 2.

Protection of staff

Unlike the groups who are first on the scene of an incident, hospital staff may not have easy access to CBW protection suits or gas masks. It is therefore essential to insist on effective decontamination procedures to be carried out before hospital admission, particularly in the case of chemical weapons. However, hospital workers remain particularly prone to secondary exposure after biological weapons attack.[87] Personal protective equipment for use by medical staff who come into contact with patients includes chemical-resistant clothing and air-purifying respirators. Staff should have received training in advance concerning the wearing and functions of protective clothing.

Strategies to reduce infection rates include the isolation of patients (for droplets, blood, body fluids and secretions), universal precautions (including gowns, gloves masks, face-shields and correct disposal of clinical waste), basic hygiene, vaccination and post-exposure prophylaxis (Fig. 2 and Tables 1 and 2).

Agents that may be used

Chemical agents

Chemical agents of warfare are chemical substances, whether gaseous, liquid or solid, which may be used

Table 1 Treatment of chemical weapon effects. 'Lethality' describes an inverse scale, 1 being the most lethal (e.g. sarin is 5000 times less lethal than an equivalent dose of botulinum toxin)

Class and weapon	Lethality	Persistence	Effects	Decontamination	Staff protection	Antidote	Further treatment
Toxins							
Botulinum	1	–	Paralysis, dysautonomia	Disrobe, soap and water, 0.5% Na hypochlorite	Universal precautions	Heptavalent, trivalent, pentavalent	Organ-supportive
Ricin	80	–	MOF, convulsions	As for botulinum			
Saxitoxin	250	–	Paralysis, MOF	As for botulinum	As for botulinum	Avian	As for botulinum
Nerve agents					As for botulinum	Guinea-pig	As for botulinum
Sarin	5000	25 min to 4 h	Cholinergic crisis, paralysis, long-term neurological sequelae	Disrobe, soap and water, 0.5% Na hypochlorite, gentle washing	Level C chemical protection suits + filtration breathing apparatus until decontaminated, then universal precautions	Atropine 2 mg i.v. every 5–10 min (paediatric: 0.02–0.05 mg kg^{-1}); pralidoxime 15–30 mg kg^{-1} i.v./i.m. slow i.v. every 1–4 h	Organ-supportive; magnesium, benzodiazepines, clonidine
Soman	3500	2–5 days	As for sarin	As for sarin	As for sarin	As for sarin	As for sarin
Tabun	20 000	1–4 days	As for sarin	As for sarin	As for sarin	As for sarin	As for sarin
VX gas	1800	3–21 days	As for sarin	As for sarin	As for sarin	As for sarin	As for sarin
Blood gases							
HCN	100 000	Few minutes	Inhibits aerobic respiration, metabolic acidosis, MOF	Water (esp. eyes and skin), soap	Level C suits + filtration breathing apparatus until decontaminated then universal precautions	Na thiosulphate 1250 mg i.v. over 10 min, Na nitrite 300 mg i.v. over 10 min, hydroxycobalamin 400 mg i.v. over 20 min	Organ-supportive; benzodiazepines (dicobalt edetate)
Cyanogen chloride	550 000	As for HCN	As for HCN	As for HCN	As for HCN	As for HCN	As for HCN
Vesicants							
Mustard gas	75 000	2–7 days	Burns, lung damage, pancytopenia	As for nerve agents; 0.5% aqueous chlorine for skin and hair	As for nerve agents	None	Respiratory support, pain relief, debridement
Choking agents							
Chlorine	950 000	Few minutes	Bronchospasm, pulmonary oedema, necrosis and haemorrhage	Disrobe, water	Universal precautions	None	Bronchodilators, careful use of i.v. fluids, ventilation
Phosgene	160 000	Few minutes	As for chlorine	As for chlorine	As for chlorine	None	As for chlorine
Vomiting agents							
Adamsite	1 500 000	–	Dehydration, gastrointestinal haemorrhage	Disrobe, water	Barrier protection	None	Anti-emetics, i.v. fluids
Tear gases							
CS gas	1 250 000	Few minutes	Lachrymation, bronchospasm	Water, soap and water	Barrier protection	None	Irrigation

because of their direct toxic effects on man, animals or plants.[54] Any chemical can be used, including heavy metals, halogenated hydrocarbons and petroleum distillates.[114] However, a certain number of chemicals have been designed, or specifically used, as weapons, because they are easy to produce, simple to assemble into a weapon, produce large numbers of casualties (both fatal and incapacitating), are difficult to treat simply (often requiring the use of expensive and scarce health resources) and disperse relatively quickly, facilitating troop invasions. Volatile chemical weapons vaporize as the temperature rises and are absorbed into the body after skin or inhalational exposure. Poorly volatile chemical weapons persist in the environment and tend to be absorbed through the skin or gastrointestinal tract.

Chemical weapons are classified according to their intended target and to their physiological effects (Fig. 3).[30]

Nerve agents (e.g. sarin, tabun, soman, VX) are extremely toxic, odourless, colourless, tasteless substances that are structurally related to organophosphate insecticides. They are irreversible inhibitors of cholinesterase enzymes and their administration results in cholinergic crisis followed by respiratory failure and polyneuropathy.

Blistering agents (vesicants) (e.g. mustard gas, lewisite) are liquids which cause chemical burns and blistering to all

Table 2 Treatment of biological weapon effects. NA=not available

Agent	Infective dose	Incubation period	Effects (after inhalation)	Staff protection	Specific treatment	Chemoprophylaxis	Vaccine	Mortality if untreated
Bacillus anthracis	8000–15 000 spores	1–5 days	Mediastinitis, meningitis, MOF	Isolation, vaccination, universal precautions	Ciprofloxacin 400 mg i.v. t.d.s., doxycycline 200 mg i.v. once then 100 mg i.v. t.d.s. Penicillin 2 MU i.v. 2 hourly + streptomycin 30 mg kg^{-1} i.m. q.d.s.	Ciprofloxacin 500 mg p.o. b.d. × 4 weeks + vaccinate; doxycycline 100 mg p.o. b.d. × 4 weeks + vaccinate	Michigan at 0, 2,4 weeks, 6, 12, 18 months then annually	Pneumonic, 100%
Yersinia pestis	100–500 organisms	2–3 days	Pneumonia, septicaemia, MOF	Isolation, universal precautions	Streptomycin 30 mg kg^{-1} i.m. q.d.s. × 10 days; doxycycline 200 mg i.v. then 100 mg i.v. t.d.s. × 14 days (chloramphenicol)	Doxycycline 100 mg p.o. b.d. × 7 days; tetracycline 500 mg p.o. q.d.s. × 7 days	Greer at 1–3 + 3–6 months	Pneumonic 100%
Viral haemorrhagic fevers	1–10 organisms	4–21 days	Coagulopathy, oedema, MOF	Isolation, HEPA masks, universal precautions	Ribavirin 30 mg kg^{-1} i.v. once then 15 mg kg^{-1} i.v. q.d.s. × 4 days then 7.5 mg kg^{-1} i.v. t.d.s. × 6 days (immunoglobulin)	NA		90% (Ebola– Zaire)
Viral encephalitides	10–100 organisms	2–6 days (VEE) 7–14 days (EEE/WEE)	Encephalitis, convulsions, coma, CNS damage	Universal precautions	Supportive, anticonvulsants	NA	Available for VEE, EEE and WEE	75% (EEE)
Francisella tularensis	10–50 organisms	2–10 days	Pneumonia, pleural effusions	Universal precautions	Streptomycin 30 mg kg^{-1} i.m. q.d.s. × 10–14 days; gentamicin 3–5 mg kg^{-1} i.v. o.d.	Doxycycline 100 mg p.o. b.d. × 14 days	Live attenuated	35%
Variola	10–100 organisms	7–10 days	Rash, secondary pneumonia	Isolation, universal precautions	Cidofovir 5 mg kg^{-1} i.v. once every 2 weeks	Vaccinia immunoglobulin	Wyeth	Unvaccinated 30%, vaccinated 3%
Burkholderia mallei	1–10 organisms	10–14 days	Septicaemia, pneumonia, lymphadenopathy	Universal precautions	Co-amoxiclav 20 mg kg^{-1} i.v. t.d.s.	Tetracycline 500 mg p.o. q.d.s. × 14 days	None	Uncertain; >30% if septicaemic
Coxiella burnetii	1–10 organisms	10–40 days	Myalgia, malaise, fever	Barrier nursing	Doxycycline 100 mg p.o. b.d. × 5–7 days	Doxycycline 100 mg p.o. b.d. 8–12 days after exposure × 5 days	Q vax	<1%
Brucella spp.	10–100 organisms	5–60 days	Malaise + cough, sacroiliitis, pancytopenia	Barrier nursing	Doxycycline 100 mg p.o. b.d. + rifampicin 900 mg t.d.s. p.o. for 6 weeks	Doxycycline and rifampicin for 3 weeks	None	< 5%
Escherichia coli O157.H2	10–100 organisms	1–5 days	Vomiting + diarrhoea, renal failure	Barrier nursing	Antibiotics not required	NA	None	<5%

epithelial (and other) tissues. After inhalation or ingestion, systemic manifestations include respiratory failure, blindness, vomiting, pancytopenia and cancer.

Choking agents (e.g. chlorine, phosgene, chloropicrin) are highly volatile liquids. After inhalation of their gas phase, early respiratory distress occurs, followed by a variable latent period and then the onset of toxic pulmonary oedema. Permanent lung damage may occur in survivors of the acute phase.

'Blood agents' (e.g. hydrogen cyanide and cyanogen chloride) inhibit cytochrome oxidases and other enzymes, interrupting cellular respiration. The resulting metabolic acidosis and tissue hypoxia lead to convulsions and cardiorespiratory arrest.

Toxins (e.g. saxitoxin, ricin and botulinum toxin) are biological products, and are the most toxic chemicals known to man. They produce death by a variety of biochemical methods.

Tear gas and harassing agents (e.g. CS gas, capsaicin spray) are sensory irritants that are used to incapacitate their targets temporarily. Similarly, *psychochemicals* (e.g. lysergic acid diethylamide) are used as incapacitants. Death occurs from an accident whilst the subject is blind or hallucinating.

Biological agents

Many micro-organisms can cause illness in humans or animals. However, biological agents of warfare are defined

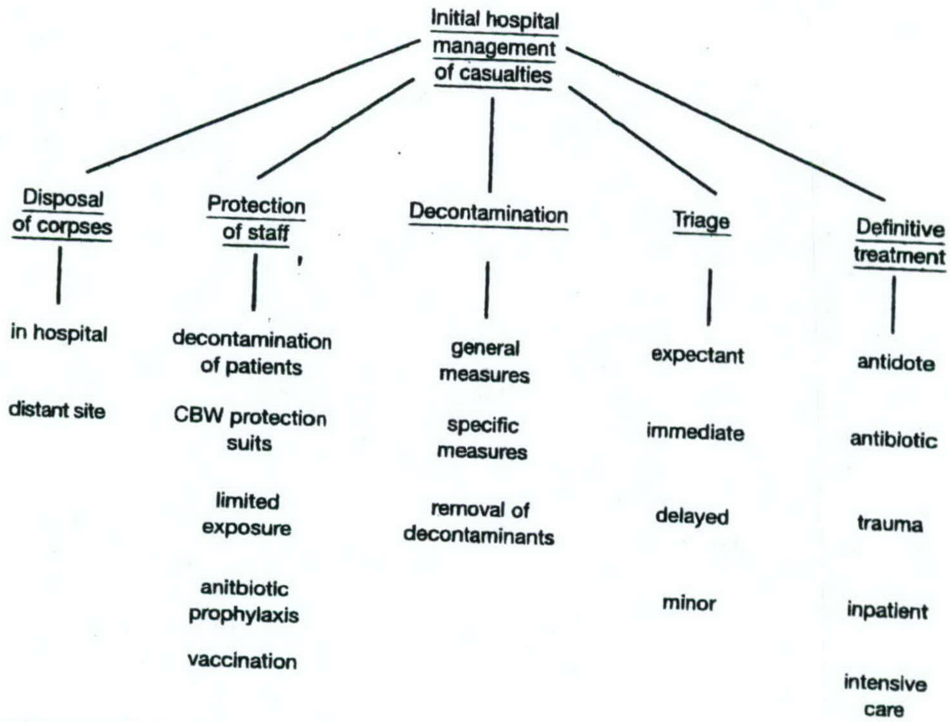

Fig 2 Initial hospital management of casualties.

as living organisms, whatever their nature, or infective material derived from them, which are intended to cause disease or death in man, animals or plants. They depend for their effects on their ability to multiply in the person, animal or plant attacked. Those chosen for use as biological weapons[119] show similar characteristics: low-dose release into an unprotected population that has poor natural immunity, and consistent production of a rapidly occurring high rate of fatality or incapacitance. In addition, the agents are easy to mass-produce and the diseases they cause are difficult to treat.[85]

Like chemical weapons, biological weapons are classified according to their intended target.[101] Agents directed towards humans and animals are subclassified according to the nature of the agent (Fig. 4).

The *viruses* used in biological warfare (e.g. those producing viral haemorrhagic fevers, viral encephalitides, variola) are highly infectious and are highly lethal. Treatment beyond supportive measures and isolation is often not possible.

Rickettsiae (e.g. Q fever and Rocky Mountain spotted fever) are less virulent than viruses, but cause endothelial cell damage that may result in cardiovascular collapse.

Bacteria are easier to culture than viruses and rickettsiae, and a number have high infectivity and lethality, including *Bacillus anthracis* (anthrax), *Yersinia pestis* (plague) and *Francisella tularensis* (tularaemia).

Fungi, *protozoa* and *parasitic worms* also cause illness and disability, but have little significance as biological weapons, being difficult to culture or having complex life cycles.

Chemical and biological weapons

Chemical weapons

Toxins

These are a group of highly noxious chemicals that are produced by living organisms. Although products of living organisms, toxins are considered by some to be chemical weapons as their effects do not require replication in the human. Over 500 exist, but in one analysis of 395 toxins only 17 were found to be suitable for battlefield (and therefore terrorist) use, because of manufacturing problems and lack of chemical stability as an aerosol.[46] Those most likely to be used are botulinum toxin, ricin and saxitoxin, although Iraq is known to have been experimenting with aflatoxin and *Clostridium perfringens* toxins. The development of specific antitoxins has proved difficult.[24]

Botulinum toxin

Clostridium botulinum strains produce seven distinct but chemically and functionally related neurotoxins (A to G). By weight, these are the most toxic chemicals known to exist. Neurotoxin A 0.001 $\mu g\ kg^{-1}$ may be fatal, making botulinum toxins (Botox) at least 5000 times more toxic than sarin nerve gas. Aerosolization of Botox is the most likely method of deployment, but the sabotage of food supplies may also occur.

All Botox serotypes bind to presynaptic receptors at cholinergic synapses. They are internalized into vesicles and translocated to the cytoplasm, where they catalyse the

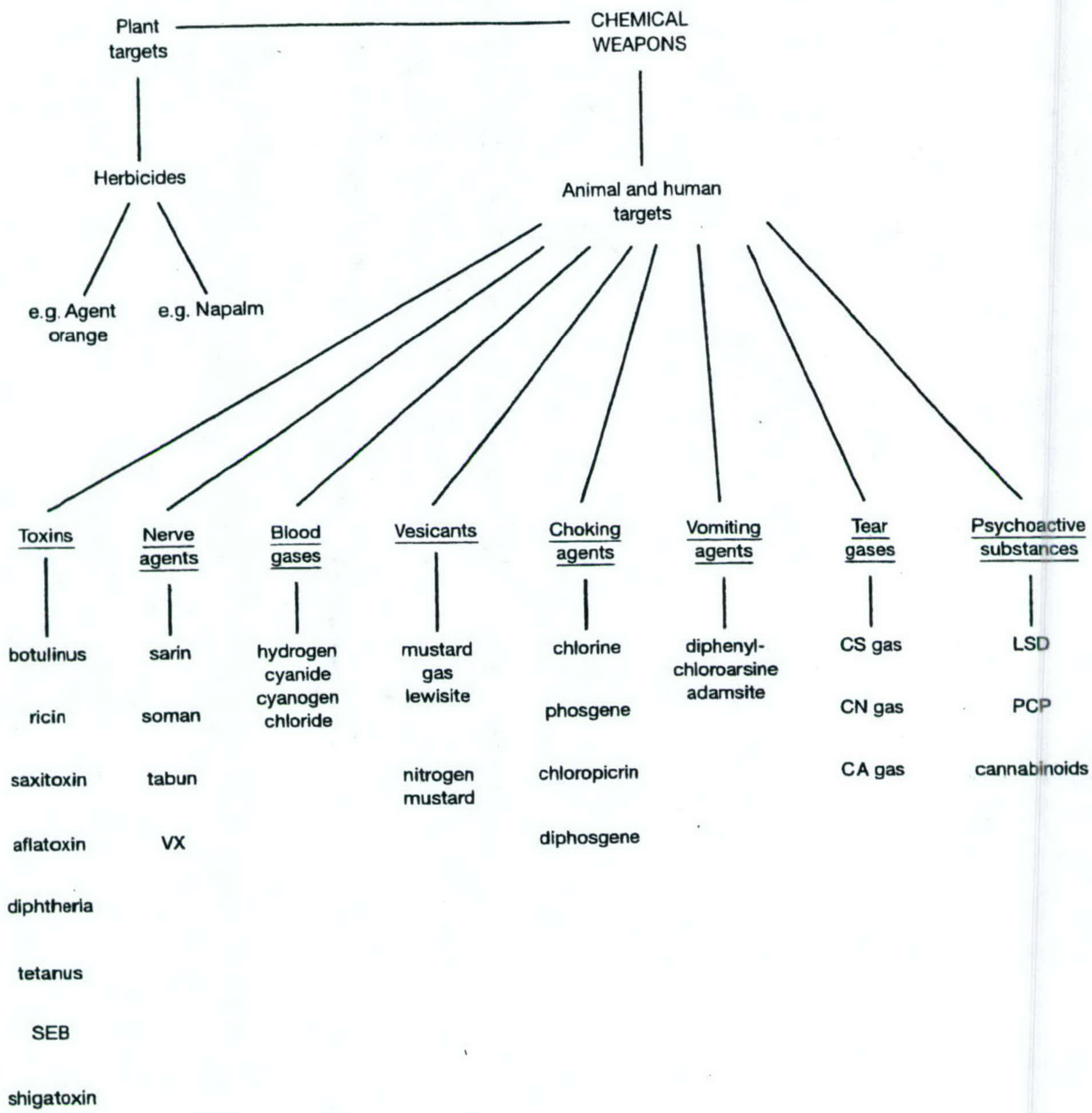

Fig 3 Classification of chemical weapons.

proteolysis of components involved in the calcium-mediated exocytosis of acetylcholine. Acetylcholine release is permanently inhibited. Functional recovery occurs by genesis of new terminal boutons. The toxin blocks neurotransmission at peripheral cholinergic synapses (including that which occurs at the neuromuscular junction), postganglionic parasympathetic synapses and peripheral ganglia.

One to four days after exposure, depending on the dose inhaled, bulbar palsy (dysarthria, dysphonia and dysphagia) and ocular symptoms (diplopia and ptosis) occur, followed by progressive, symmetrical, descending weakness that culminates in respiratory failure requiring prolonged ventilation over several weeks or months. Standard decontamination procedures are sufficient to prevent exposure of health-care workers during the early phase of treatment after deliberate deployment of Botox. Botox is inactivated within 12 h. Early ventilatory support is associated with a fatality rate of less than 5%.[113] Dysautonomia may result in mydriasis (with photophobia) and hypotension (requiring haemodynamic support). Interestingly, a Tensilon (edrophonium) test, used to exclude a diagnosis of myasthenia gravis in isolated cases, may be transiently positive after Botox inoculation.[91] Single-fibre electromyography may be used to confirm the diagnosis.[6]

A heptavalent antitoxin exists for all serotypes of Botox, but its human efficacy is not known.[65] A trivalent antitoxin exists for serotypes A, B and E, which appears effective if

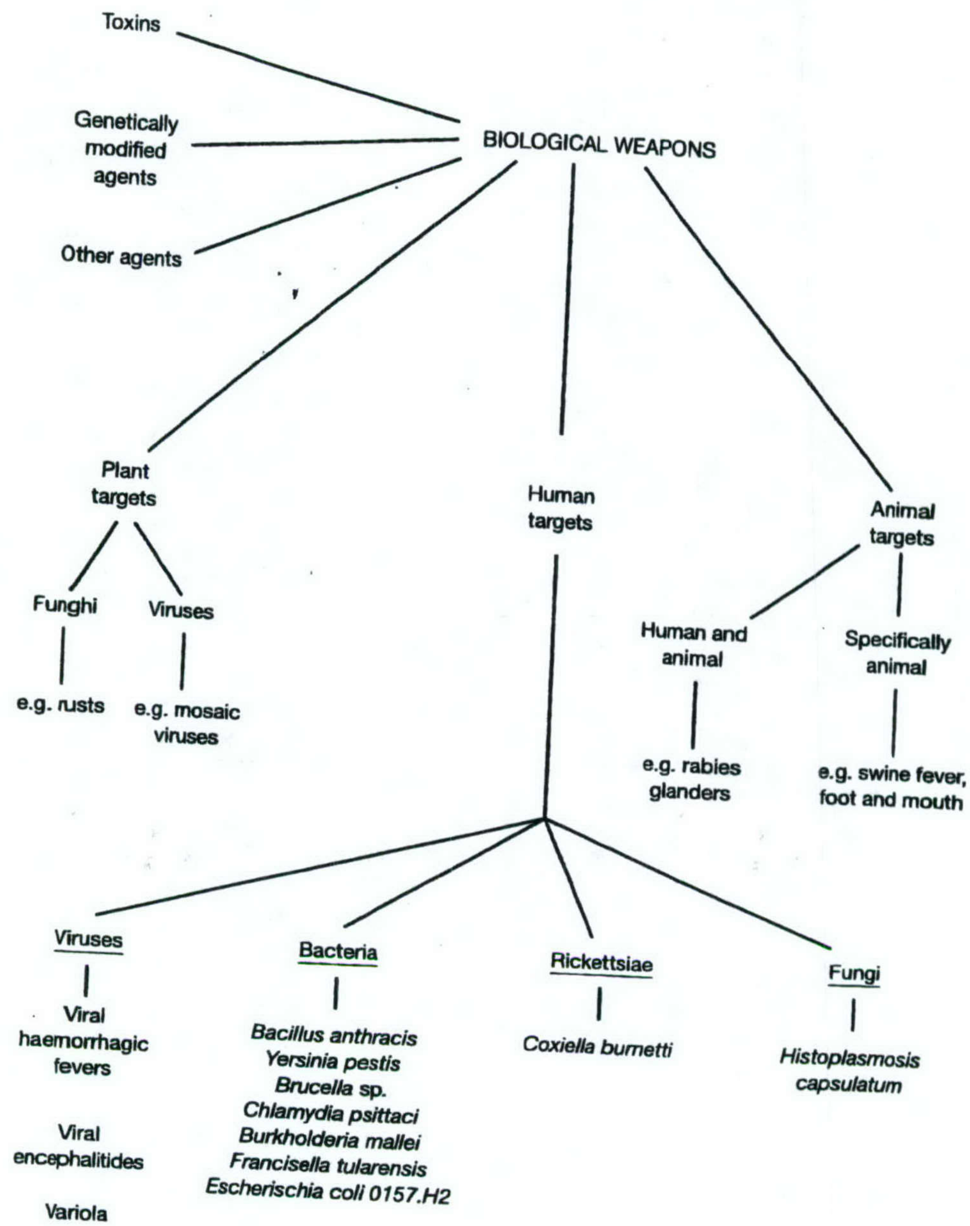

Fig 4 Classification of biological weapons.

given shortly after oral ingestion of Botox. A pentavalent form is under development.

Ricin

Ricin is a protein derived from the seeds of the castor bean plant, *Ricinus communis*. Waste from the commercial production of castor oil contains 5% ricin, making it easy for such a substance to fall into the hands of bioterrorists. Structurally,[69] ricin consists of two polypeptide chains, one of which binds to the surface of cells, the other catalysing the *N*-glycosidic cleavage of a specific adenine residue from 28S ribosomal RNA, interrupting protein synthesis. Ingestion produces abdominal pain and diarrhoea. Inhalation of high doses is rapidly fatal; lower doses are associated with drowsiness, confusion, convulsions, coma, extreme weakness, respiratory failure and cardiovascular collapse, progressing to multiple organ failure and death within 36–72 h. Treatment is supportive. An avian ricin antitoxin has been developed for use in animals.[66]

Saxitoxin

Saxitoxin is produced by dinoflagellate sea organisms (those responsible for the red tide).[103] including *Alexandrium tamarense*, *Gymnodinium catenatum* and *Pyrodinium bahamense*. It is concentrated in shellfish and is responsible for

cases of paralytic shellfish poisoning.[103 124] The LD50 (lethal dose that kills 50% of those exposed) in mice is 8 μg kg^{-1}, making the chemical at least 20 times more lethal than sarin nerve gas. Saxitoxin is a potent, selective inhibitor of voltage-gated sodium ion channels.[124] Ingestion produces a prodrome of gastrointestinal upset, with cramping and diarrhoea. Inhalation is rapidly fatal and is characterized by bulbar palsy and respiratory and cardiovascular failure.[113] Treatment is organ-supportive. An antitoxin has been developed in guinea-pigs, but its use appears not to reverse the central neurological effects of saxitoxin poisoning.[13]

Nerve agents

Nerve agents are anticholinesterases of high potency.[126] They were first mass-produced in Germany in April, 1942 (tabun gas). Each year, organophosphate insecticides, which are structurally related, cause several hundred thousand casualties worldwide. The four most commonly produced agents are sarin (GB, isopropyl methylphosphonofluoridate), soman (1,2,2-trimethylpropylmethyl-phosphonofluoridate), VX gas (*O*-ethyl-*S*-2-diisopropylaminoethyl-methylphosphonothiolate) and tabun (ethyl *N,N*-dimethylphosphoramidocyanidate). However, there are several other nerve gases that have been chemically modified in order to penetrate gas-protection suits and to persist after deployment. Impure sarin has been produced by several terrorist organizations and states with terrorist links, and is considered one of the more likely agents to be deployed deliberately.

The nerve agents are ester or amide derivatives of phosphonic acid and are structurally related to organophosphate insecticides (such as malathion). They inactivate acetyl cholinesterase (AChE) by alkyl phosphorylation of a serine hydroxyl group at the esteratic site of the enzyme.[58] Inactivation of AChE prevents the hydrolysis of acetylcholine, which accumulates at muscarinic, nicotinic and central nervous synapses. At muscarinic synapses, AChE inactivation cause miosis, ciliary body spasm (at high doses causing eye pain),[59] glandular hypersecretion (salivary, bronchial and lachrymal), sweating, bradycardia (or atrioventricular block, QT prolongation), bronchoconstriction, vomiting, severe diarrhoea and urinary and faecal incontinence. AChE inactivation at nicotinic receptors produces skeletal muscle paralysis (initial fasciculations followed by weakness and muscular paralysis). The adrenal medulla is stimulated, causing tachycardia and hypertension. At central nervous cholinergic synapses,[98] AChE inactivation causes irritability, giddiness, ataxia, fatigue, amnesia, hypothermia, lethargy, seizures, coma and respiratory depression.

Nerve agents also appear to bind to nicotinic, cardiac muscarinic and glutamate NMDA (*N*-methyl-D-aspartate) receptors directly, suggesting that they may have additional mechanisms of action yet to be defined. In addition, nerve agents antagonize GABA (γ-aminobutyric acid) neurotransmission, which may cause seizures and central nervous symptoms.

Significant exposure incapacitates within 1–10 min and kills within 1–15 min (4–24 h for VX gas). Generalized effects and immediate death are caused by the rapid absorption of nerve agent vapour through the respiratory tract. The effects of cutaneous exposure to liquid nerve agents depend on the anatomical site exposed, the ambient temperature and the dose of nerve agent. Percutaneous absorption of a nerve agent results in localized sweating, followed by muscular fasciculations and weakness with increased depth of dermal penetration. Although nerve agents are highly lipophilic, transdermal systemic toxicity is delayed compared with their inhalational toxicity.

A triphasic clinical syndrome develops after exposure. Initially, a cholinergic phase occurs. Acetylcholine accumulation may result in death from bronchoconstriction, vocal cord paralysis,[117] bradycardia, convulsions or paralytic respiratory failure. This phase lasts 24–48 h and requires intensive care treatment, including organ-supportive therapy, atropine, oximes and magnesium. Succinylcholine causes prolonged paralysis because of concomitant butyrylcholinesterase inhibition.[38] Non-depolarizing neuromuscular blocking agents are likely to have a significantly prolonged effect, and their reversal will not be effected by carbamate esters (neostigmine, pyridostigmine) once irreversible inactivation of AChE has occurred. However, by occupying acetylcholine receptors, non-depolarizing neuromuscular blocking agents may prevent the receptors from acetylcholine-mediated damage.[2] Repeated doses of neostigmine have similar effects to nerve agents at the nicotinic receptor.[92] Ketamine may be beneficial for intubation. Although it increases oropharyngeal secretions (as do nerve agents), *in vitro* studies have shown that ketamine protects AChE; the *in vivo* significance of this is not known.[27]

The second phase, or 'intermediate syndrome',[107] begins after the cholinergic phase and lasts 4–18 days depending on the *de novo* resynthesis rate of AChE (usually 1% of pre-exposure AChE function is recovered per day). This phase is characterized by muscle weakness, particularly of the diaphragm, and is associated with respiratory failure and cranial nerve palsies. Treatment necessitates ventilation and supportive care. It is important to highlight that the first phase of organophosphate poisoning is associated with *depolarizing* neuromuscular block (resulting from prolonged, high intrasynaptic acetylcholine concentrations), whereas the second phase is associated with *non-depolarizing* neuromuscular block (due to acetylcholine receptor down-regulation).[6 8]

After instances of industrial organophosphate poisoning, a third phase has been seen. This is associated with delayed polyneuropathy,[71] occurs 7–14 days after exposure, and is characterized by symmetrical, peripheral muscle weakness in addition to disturbances of sensation. The cause of polyneuropathy is thought to be inactivation of another

enzyme, *neuropathy target esterase*. Minimal data exist to ascertain whether a similar phase exists after exposure to nerve agents. However, persistent postural imbalance, shoulder stiffness and blurred vision have been reported in the years after exposure.

Pyridostigmine bromide may be used as a 'pretreatment' by soldiers or other emergency personnel for whom exposure to nerve agents is expected (though it is not a true pretreatment, which would protect against nerve agents, but an 'antidote enhancer').[74] Nerve Agent Pyridostigmine Pretreatment (NAPP) packs contain 21 tablets, one tablet (30 mg) to be taken every 8 h. Pyridostigmine is a reversible, competitive, carbamate ester antagonist of AChE. Excessive administration of pyridostigmine would have similar effects to nerve agents. However, the doses used in NAPP packs are so low that only about 30% of erythrocyte AChE is inhibited. The rationale of pretreatment is that pyridostigmine carbamylation of AChE binding sites produces a reservoir of temporarily inactivated AChE. After exposure, nerve agents are unable to bind to the carbamylated enzyme. Later dissociation of pyridostigmine reactivates AChE, which, by hydrolysing acetylcholine, reduces the incidence of cholinergic crisis (in conjunction with atropine and pralidoxime). However, pyridostigmine alters the pharmacodynamics of depolarizing and non-depolarizing neuromuscular blocking agents. Pyridostigmine increases intrasynaptic acetylcholine concentrations. Therefore, less succinylcholine is required to produce phase I block (paralysis), but a relatively greater dose of non-depolarizing neuromuscular blocking agent will be required to effect paralysis.[62] A smaller dose of neostigmine might be required to reverse non-depolarizing neuromuscular blockade.

Atropine and *oximes* are effective antidotes if administered early after exposure.[76 123] Atropine antagonizes muscarinic side-effects and is more beneficial than glycopyrrolate, which has a shorter half-life and does not cross the blood–brain barrier. Atropine 2 mg is given i.v. (paediatric dose, 0.02–0.05 mg kg^{-1}), with repeated dosing at 5–10 min intervals until pupillary dilatation occurs[86] and the heart rate rises above 80 beats min^{-1}. Atropine infusion (0.02–0.08 mg kg^{-1} h^{-1}) is advocated for resistant bradycardia.[96] Up to 1000 mg per day may be required to antagonize the muscarinic side-effects of nerve agents, doses which may themselves cause significant side-effects, such as paralytic ileus.[11] In addition, by blocking presynaptic inhibitory muscarinic receptors, neuromuscular transmission may be enhanced.[75]

Oximes reverse nicotinic receptor dysfunction and reduce or reverse paralysis.[9 36] They have three beneficial effects in nerve agent poisoning. Administered early, oximes reactivate AChE by cleavage of phosphorylated active sites. They detoxify unbonded nerve agent molecules by direct reaction and in normal doses have an endogenous anticholinergic effect. The rate of covalent bonding between AChE and nerve agents is agent-specific. Irreversible covalent bonds have formed 2 min after exposure to soman, after 5 h for sarin, after 13 h for tabun and after more than 48 h for VX gas. This provides a therapeutic window in which some of the paralytic effects of nerve gases may be prevented by oxime administration. It is recommended that atropine and pralidoxime are co-administered.[55] Slow i.v. injection of pralidoxime is desirable to prevent laryngospasm, muscle rigidity and hypertension. Pralidoxime 15–30 mg kg^{-1} i.v./i.m. over 20 min, for adults and children, may be repeated after 4 h (or 1 h if paralysis is worsening), to obtain a therapeutic blood concentration of pralidoxime of 4 μg ml^{-1} (although it has been suggested recently that exploitation of the full therapeutic potential of pralidoxime may occur at a higher blood concentration).[130] *In vitro* studies have found obidoxime to be a more potent reactivator of AChE than pralidoxime. The possibility of re-inhibition of reactivated AChE (manifested by worsening paralysis after administration of pralidoxime) should be borne in mind,[131] and may be amenable to treatment using edrophonium.[72] Concurrent use of barbiturates (which potentiate side-effects) and morphine (which worsens respiratory function and confusion) should be avoided.

Other pharmacological agents which may be used include diazepam (anticonvulsant),[70 79] clonidine (to control central nervous cholinergic symptoms),[3] inotropes (although adrenal medulla stimulation in acute toxicity may produce positive inochronotropism, necessitating α and β adrenoceptor blockade) and magnesium (which reduces presynaptic acetylcholine release).[111]

Blood agents

Blood agents, notably hydrogen cyanide (prussic acid, 'AC') and cyanogen chloride ('CK'), are metabolic poisons that are fatal within 15 min after a lethal dose.[10] Hydrogen cyanide is a colourless liquid that smells of almonds. It is disseminated as a vapour, but because of its high volatility it is rapidly dispersed throughout the atmosphere to non-toxic concentrations. Hydrogen cyanide poisoning is encountered more commonly after industrial spillage or house fires. Cyanides are potentially available to terrorists, being widely used in industry.

Cyanide is removed by the standard-issue respirators used as part of Level C personal protective equipment. Inhalation produces high fatality rates before hospitalization. The LCt50 (concentration that kills 50% of those exposed) is 200 mg m^{-3} for 10 min. A dose of 300 mg is invariably fatal, but lower doses are survivable. Cyanide binds to the trivalent iron atom of cytochrome oxidase enzymes, inhibiting catalytic function. Histotoxic hypoxia results from the interruption of cellular oxygen utilization. Dizziness, confusion and tachypnoea are followed rapidly by convulsions, coma and cardiorespiratory arrest. Arterial blood gas analysis shows metabolic acidosis, hyperlactataemia and a reduced arteriovenous oxygen difference

(because of low tissue oxygen uptake). Treatment in an intensive care unit is warranted.

Specific antidotes exist. Sodium thiosulphate (1250 mg i.v. over 10 min) converts cyanide to non-toxic thiocyanate, and is administered in conjunction with sodium nitrite (300 mg i.v. over 10 min), which converts haemoglobin to methaemoglobin (a compound that binds cyanide), and hydroxycobalamin (400 mg i.v. over 20 min), which reacts with cyanide to form cyanocobalamin. An infusion of norepinephrine may be required to counteract the hypotensive side-effects of sodium nitrite. Methaemoglobin levels should not be allowed to rise above 40%. Dicobalt edetate (300–600 mg i.v., repeated as necessary) is reserved for second-line treatment because of its side-effects (hypertension and nausea).

Blistering agents (vesicants)

There are two main classes of vesicant. Arsenicals, such as lewisite (2-chlorovinyl dichloroarsine), are more volatile and have sharp, irritating odours. Conjunctival exposure causes immediate eye pain. Mustards, such as mustard gas and nitrogen mustard, are poorly volatile, practically odourless and cause no initial eye pain. The debilitating and lethal complications of mustard gases make their use far more likely than that of arsenical vesicants.

Mustard gas [bis (2-chloroethyl) sulphide] is a colourless or pale yellow oily liquid, that smells faintly of mustard or garlic.[16] The threshold for odour sensation is 1.3 mg m^{-3}, which is significantly below battlefield concentrations (approximately 25 mg m^{-3}), allowing several minutes of detection before incapacitating or lethal doses are reached [ICt50 200–1000 mg min m^{-3} (concentration that incapacitates 50% of those exposed) and LCt50 1500 mg min m^{-3}]. Atmospheric release occurs through explosive aerosolization. Because of its low volatility, mustard gas has greater clinical effects in hotter climates, but it persists longer in more temperate climates. Its persistence places medical responders at greater risk of intoxication; the wearing of protective clothing (including respirators), together with decontamination of both casualties and responders, is essential.

Mustard gas forms highly reactive sulphonium ions in the body, which alkylate sulphydryl and amino groups on macromolecular proteins, such as DNA and enzymes. In the long term, dose-related carcinogenesis,[45] particularly of the pharynx, skin and respiratory tract occurs.

Acutely, the clinical manifestations of exposure to mustard gas result from NAD^+ depletion, which disrupts glycolysis and causes the release of destructive proteases. Common to all systemic complications is a period of latency between exposure and the development of symptoms. Suspected exposure necessitates careful clinical observation and review of the patient.

Cutaneous manifestations are universal. After a latent period of 4–12 h, diffuse erythema occurs over exposed skin, with oedema and first-degree chemical burns. Severe oedema and vesication, particularly in the axillae and groins, occurs with greater exposure. Severe cutaneous injury, with necrosis and spreading vesication, is seen with exposure to high doses over a period of minutes. Skin burns are painful, prone to infection and slow to heal. Systemic pain relief is required. Fluid therapy is administered according to burn protocols if cutaneous damage is severe. Consideration should be given to wound care and antibiotic prophylaxis. Surgical debridement may be required for more severe lesions, particularly if tissue is necrotic, and split-skin grafting may be necessary.

Ocular symptoms are reported in 85% of patients. After several hours' latency, eye pain, blurred vision and lachrymation occur. Visual acuity is decreased as a result of corneal oedema and vesication. After sloughing of the cornea, vision recovers by corneal revascularization over a period of weeks (although exposure to high doses can cause permanent blindness).[33] Initial irrigation with copious amounts of saline should be followed by an ophthalmological opinion. Corneal abrasions require treatment with an antibiotic ointment in conjunction with a cycloplegic, such as homoatropine (though this should not be used if there has been contemporaneous use of nerve gas).

Respiratory complications occur in more than 70% of victims.[7] [121] After a delay of several hours, inhalation of mustard gas causes tracheobronchitis, with symptoms of a dry cough and hoarseness. Tachypnoea and sinusitis occur over the next 12 h. Bronchospasm is common. Airway collapse occurs distal to areas of sloughed respiratory epithelium. Severe exposure results in pulmonary haemorrhage and oedema, secondary infection and respiratory failure (within 24 h), necessitating ventilation in the intensive care unit. Lung damage may be permanent, and can include chronic obstructive pulmonary disease, bronchiectasis and reactive airways dysfunction syndrome. Acute upper airway obstruction may require cricothyroidotomy, though this may be technically difficult if tracheitis is severe.

Bone marrow suppression occurs after high-dose exposure (hence the use of nitrogen mustards, such as melphalan and cyclophosphamide, for the treatment of haematological malignancy). Leucocytosis for several days is followed by leucopenia, which is worst on day 10. Thrombocytopenia and, less commonly, anaemia are seen. Secondary infection and bleeding are possible. Bone marrow suppression after exposure carries a poor prognosis, though this may be coincident to a summation of systemic dysfunction after high-dose exposure.

Experimentally (in animals), a parenteral combination of sodium thiosulphate (3000 mg kg^{-1}), vitamin E (20 mg kg^{-1}) and dexamethasone (8 mg kg^{-1}) improved survival and reduced organ damage after exposure to mustard gas.[16] A specific topical or systemic antidote does not exist.

Although mustard gas is severely incapacitating, fatality rates are reported to be less than 5% after battlefield

exposure, most deaths resulting from respiratory and bone marrow failure.[39]

Choking agents

Choking agents are the classical agents of chemical warfare. Chlorine and phosgene ($COCl_2$) were first used (often in combination) in 1915.[19] However, their acrid smell and respiratory irritancy acted as early warning signals for exposed troops, who were able to don effective gas masks before severe poisoning occurred; their use was superseded by blistering agents in 1917. Chlorine and phosgene are widely used as intermediaries in manufacturing processes (e.g. synthesis of plastics) and poisoning may be encountered after industrial accidents.

Chlorine is a greenish-yellow gas with a distinctive smell and is denser than air. As its odour threshold of 0.08 p.p.m. occurs below that associated with toxicity, the sense of smell usually provides adequate warning of atmospheric chlorine. It is an oxidizing agent, and reaction with water liberates hypochlorous acid, hydrochloric acid and oxygen free radicals, all of which cause tissue damage. Initial ophthalmic exposure rapidly produces eye pain, blepharospasm and lachrymation.

Phosgene is a colourless gas that smells of newly mown hay. An odour threshold of 1.5 p.p.m. has been reported in some humans, but this does not protect against toxic inhalation effects. Olfactory fatigue may occur with a large exposure. It is four times heavier than air and therefore remains close to the ground, maintaining high concentrations, for example, in trenches and cellars. Exposure to concentrations of 3 p.p.m. may not cause noticeable symptoms for 12–24 h. Exposure to 50 p.p.m. may be fatal within an hour. Damage caused by phosgene results from the presence of a highly reactive carbonyl group attached to two chloride atoms. The gas dissolves slowly in water, undergoing hydrolysis to form carbon dioxide and hydrochloric acid. Slow dissolution allows phosgene to enter respiratory tissue without significant upper airway damage. Necrosis follows inflammation of delicate terminal airways and alveoli. Alveolar capillaries leak large volumes (up to 1 litre h^{-1}) of serum into the alveolar septa, producing pulmonary oedema.

Morbidity and mortality are related to the degree of pulmonary damage. From December 1915 to August 1916, casualties from phosgene exposure occurred in 4.1% of gas-exposed troops and death occurred in 0.7%. Fatality amongst an unprotected population would undoubtedly be higher.

Exposure to choking agents irritates the eyes and nasopharynx, with coughing and dyspnoea. Laryngospasm may occur with high-dose exposures. Respiratory failure ensues as pulmonary oedema worsens. Hypoxaemia and ischaemia progress to multiple organ dysfunction and failure.

The management of choking agent toxicity is supportive. Corticosteroids (inhaled or i.v.), in doses greater than that conventionally used in asthma, are recommended, as are β_2 agonists and prophylactic antibiotics (because of the risk of secondary respiratory infection). Leukotriene inhibitors (oral zafirlukast 40–80 mg 12-hourly for the initial 48 h) and glutathione may lessen respiratory damage after phosgene poisoning.[49 106]

Vomiting agents and incapacitating agents

Although vomiting agents[40] (such as adamsite and diphenylchloroarsine), tear gases [such as 2-chlorobenzalmalononitrile (CS gas) and capsaicin spray][132] and psychoactive drugs (such as LSD and cannabinoids) may be severely debilitating, they are less likely to require intensive care treatment than the chemicals described above. The pathophysiology associated with their use is not considered further in this review.

A summary of the treatment of people affected by these chemical agents is given in Table 1.

Biological weapons

The organisms discussed below are listed approximately in the order of their lethality to an unprotected and untreated population after deliberate release.[47]

Anthrax

Bacillus anthracis is an aerobic, Gram-positive, rod-shaped, spore-forming bacterium[37] that primarily infects herbivores (particularly cattle, sheep, goats and horses).[108] The reservoir of *B. anthracis* is the soil and the organism is distributed worldwide. Sporadic outbreaks occur in parts of Asia and Africa. The spores can remain viable for decades—released onto Gruinard Island (off the coast of Scotland) in 1941, anthrax spores persisted until decontamination was carried out in 1986. Susceptible livestock that ingest the spores while grazing have a high mortality rate and, in the process of dying, bleed from the respiratory tract and bowel, further contaminating the environment. Humans usually contract anthrax through close contact with infected animal products, particularly hair and hides.

Anthrax spores were incorporated into weapon systems by the USA in the 1950s. Iraq admitted to having developed anthrax weapon delivery systems in 1995. In 1979, 66 people died after an airborne leak of anthrax spores from a military facility, south of Sverdlovsk (Ekaterinburg), in the USSR.[1] Fifty kilograms of aerosolized *B. anthracis* released two miles upwind of a population centre of 500 000 unprotected people, would kill an estimated 95 000 people, effecting 24.7 billion dollars worth of damage.[61]

Three clinical presentations are recognized in humans.[95] Ninety-five per cent of cases exhibit cutaneous anthrax, resulting from inoculation of spores through skin abrasions.

Ingestion of contaminated meat can lead to gastrointestinal anthrax. Inspiration of anthrax spores can result in the highly lethal inhalational form of the disease (Woolsorter's disease).

Cutaneous anthrax appears within 5 days of exposure, beginning with small, painless, pruritic papules, which evolve within 48 h to form vesicles, surrounded by gross oedema. The vesicles rupture within a week to leave an ulcer that resolves as a black eschar (hence 'anthrax', after the Greek word for coal). The eschar sloughs after a further 2–3 weeks.

Gastrointestinal anthrax occurs after ingestion of contaminated meat. Pharyngeal ulcers and oedema may necessitate artificial maintenance of the airway. Haemorrhagic mesenteric adenitis, with ascites, haematemesis and bleeding *per rectum*, may occur. Late recognition of the cause of such non-specific signs accounts for a high case fatality.

It has usually been considered that anthrax spores, when used as a biological weapon, would be delivered as an aerosol, to produce the maximum number of cases of inhalational anthrax. However, the recent deliberate release of anthrax spores via the US postal system has been in the form of a powder. This produced cutaneous and inhalational anthrax, with only a few fatalities. An infective dose consists of 8000–15 000 spores. Inhaled spores more than 5 μm in diameter are trapped in the upper airways and cleared by the mucociliary system. Spores between 2 and 5 μm reach the alveoli. Pulmonary macrophagocytosis removes the spores to the mediastinal and hilar lymph nodes. After a germination period of 1–3 days, a large amount of anthrax toxin is released into the circulation. Anthrax toxin consists of three proteins. Protective antigen is the central component of the toxin and binds the other two components, oedema factor and lethal factor, transferring them across membranes, where their intracytoplasmic release enables their effects. Oedema factor is a calmodulin-dependent adenyl cyclase that converts adenosine triphosphate (ATP) to cyclic adenosine monophosphate (cAMP).[68] Increased intracellular concentrations of cAMP result in tissue oedema and suppression of the oxidative burst associated with polymorphonuclear phagocytosis.[89] Lethal factor appears to increase macrophage expression of both tumour necrosis factor (TNF) and interleukin-1 (IL-1),[94] cytokines that are integral to the systemic inflammatory response to infection.

Initially, there is an insidious onset (over 1–4 days) of malaise, fatigue, myalgia, non- productive cough and fever, presumably related to elevated concentrations of TNF and IL-1. A necrotizing haemorrhagic mediastinitis ensues, manifested in chest discomfort, acute dyspnoea and stridor. Haemorrhagic meningitis with coma and meningism occurs in 50% of patients. Multiple organ failure (MOF) ensues, which is invariably refractory to treatment, death occurring within 24–36 h. Physical findings are non-specific. Chest radiography may reveal pulmonary haemorrhage, effusion or oedema in addition to mediastinal widening. Bacilli and toxin appear in the blood 36 h after inhalational inoculation. An enzyme-linked immunosorbent assay (ELISA) is available to rapidly detect circulating toxin, the concentration of which parallels the development of bacteraemia. Gram staining and culture of blood samples aid identification (though the bacteria does not sporulate *in vivo*).

Historically, penicillin was used to treat anthrax. However, it has proved possible to bioengineer penicillin resistance in *B. anthracis*. Currently, it is recommended that treatment be commenced as early as possible with i.v. ciprofloxacin 400 mg every 8 h. Doxycycline 200 mg i.v. followed by 100 mg i.v. every 8 h may be used as an alternative, as may penicillin with streptomycin, gentamicin, erythromycin or chloramphenicol (Table 2). Resistance to third-generation cephalosporins, sulfamethoxazole and trimethoprim has been reported. Chemoprophylaxis, before or soon after anthrax release, consists of ciprofloxacin 500 mg every 12 h orally or doxycycline 100 mg every 12 h orally, which is continued for 4 weeks or until three doses of vaccine have been given.[21] An attenuated vaccine (Michigan vaccine) is available, which is injected subcutaneously at 0, 2 and 4 weeks, then at 6, 12 and 18 months with annual boosters. New recombinant vaccines that target the protective antigen moiety of the anthrax toxin are being developed. If vaccination is not available, antibiotic chemoprophylaxis should be continued for 60 days after exposure.

Plague

Yersinia pestis is an anaerobic, Gram-negative coccobacillus. Plague is transmitted to humans in one of three ways: by flea vectors (usually *Xenopsylla cheopsis*) from rodent reservoirs, by animal-to-human droplet infection or by human-to-human droplet infection.[20 81 93] There is documented evidence of the use of plague as a biological weapon as far back as the fourteenth century, when the Tatars catapulted cadavers infected with plague into the city of Kaffa (now Feodosiya in the Ukraine).[26] Between 100 and 500 organisms constitute an infectious dose. Bubonic, septicaemic or pneumonic[127] forms of infection are recognized, the last being the most likely result of deliberate epidemic. After an incubation period of 2–3 days, the victim develops pneumonia, associated with malaise, high fever, myalgia, haemoptysis and sepsis. Patchy consolidation is seen on chest radiography. Dyspnoea, stridor and cyanosis rapidly ensue, necessitating mechanical ventilation, with organ support for coexistent MOF. Precautions against droplet infection should be taken. *Y. pestis* infection[87] may be suspected on finding a Gram-negative coccobacillus in peripheral blood, sputum or lymph-node specimens, and confirmed by culture of the organism from blood and sputum, immunofluorescence or ELISA.

Bubonic plague has a 40% fatality rate if left untreated. Septicaemic plague has a fatality rate of 100% if untreated, but 60% of cases survive if appropriate antibiotic therapy is

administered quickly. Pneumonic plague is invariably fatal unless treatment is commenced within 24 h of the onset of symptoms. Intramuscular streptomycin 30 mg kg^{-1} every 12 h for 10 days is used as first-line therapy. Gentamicin is an alternative, as are doxycycline and chloramphenicol. Chloramphenicol is preferred if *Y. pestis* meningitis is diagnosed or the patient has haemodynamic compromise. Chemoprophylaxis is provided by tetracycline or doxycycline. An inactivated vaccine (Greer vaccine) is available, but its efficacy against pneumonic plague is thought to be poor.[34]

Viral haemorrhagic fevers

Viral haemorrhagic fever (VHF) describes a range of symptoms that are caused by infection with a variety of RNA viruses.[116] *Arenaviridae* give rise to Lassa,[88 94] Junin[122] and Machupo[32] fevers, *Bunyaviridae* to Rift Valley fever,[64] Hantavirus fever and Crimean–Congo fever, *Filoviridae* to Ebola[28 128 129] and Marburg disease and *Flaviviridae* to yellow fever and dengue fever. VHF viruses are usually transmitted from infected animal reservoirs to man by arthropod vectors.[48 88] All VHF viruses are highly infectious when delivered by aerosol (one to 10 organisms produce clinical infection) and have high morbidity and mortality rates (up to 90% with Ebola-Zaire), even after treatment.

Clinically, VHF is characterized by symptoms resulting from endothelial damage, although initially there may only be non-specific signs of infection—malaise, fever and myalgia. Vasculopathy, oedema[14] and coagulopathy[25] may lead to external or internal haemorrhage. Shock and MOF may ensue. Coagulopathy may be compounded by liver failure. Certain clinical characteristics predominate to distinguish the viral cause of VHF. For example, Rift Valley fever produces more prominent haemorrhagic and neurological manifestations than are seen with Junin virus infection, and renal failure is more prevalent in Hantavirus infections. Diagnosis is by antigen-capture ELISA or reverse transcriptase–polymerase chain reaction.

Treatment is mainly supportive. Isolation with contact precautions (particularly if haemorrhage is massive) is required. Careful nursing and pressure care prevent trauma to fragile tissue. Intravenous access is difficult because of oedema, and may lead to haemorrhage from venepuncture sites. Fluid therapy and the treatment of haemorrhage are controversial. Patients are often fluid-replete, with intravascular fluid depletion. Excessive crystalloid infusion in patients with increased vascular permeability may precipitate pulmonary oedema, necessitating mechanical ventilation. Mild haemorrhage may be tolerated provided it does not result in shock with organ ischaemia (particularly renal ischaemia). Similarly, prothrombotics should be avoided unless haemorrhage is excessive or there is laboratory confirmation of disseminated intravascular coagulopathy. Secondary infection is common and requires aggressive, early chemotherapy.

Ribavirin, a nucleoside analogue with a broad spectrum of antiviral action, is of benefit when given to patients with Lassa fever, Junin fever and Rift Valley fever. Vaccines have been developed for Rift Valley fever and are under development for Ebola fever.[115]

Viral encephalitides

Three members of the genus *Alphavirus* (of the family Togaviridae) cause viral encephalitis in humans: Venezuelan,[99 125] Eastern and Western equine encephalitis viruses (VEE, EEE and WEE respectively). They are highly infectious (10–100 organisms cause clinical symptoms) and stable when weaponized. Mortality may be as high as 75% (EEE). VEE inevitably produces symptomatic infection, with chills, high fever, malaise, myalgia and vomiting. Fewer than 5% of those infected develop neurological involvement. After a prodrome of up to 11 days, those infected with EEE and WEE present with fever, vomiting, headache and malaise that intensify over the next few days, progressing to delirium, somnolence and coma, requiring intensive care management. Early leucopenia is followed by leucocytosis. Elevated serum aspartate transaminase concentrations are common in VEE infections. Analysis of cerebrospinal fluid from patients with neurological symptoms reveals lymphocytic pleiocytosis, with a cell count of up to 500×10^9 $litre^{-1}$. ELISA testing and viral isolation are diagnostic.

No specific therapy exists, and treatment is therefore supportive. Neurological protection strategies, ventilatory support, anticonvulsant therapy and antipyretic measures may be beneficial and reduce long-term neurological morbidity.[67] Significant neurological morbidities, including epilepsy, spastic paralysis and cranial nerve lesions, are seen in 30% of survivors of EEE; this figure is higher amongst paediatric and elderly populations.

Vaccines for VEE, EEE and WEE are available[51 78] but the WEE and EEE vaccines are poorly immunogenic, requiring repeated immunization.

Tularaemia

Tulareamia[82] (rabbit fever, deer fly fever) is caused by *Francisella tularensis*, a small, aerobic, intracellular Gram-negative coccobacillus.[12] Transmission to humans normally takes place after inoculation by arthropod vectors. The ingestion of infected meat or inhalation of aerosolized bacteria may also result in infection, which may be produced by as few as 10–50 organisms.

The more common ulceroglandular form of the disease occurs after inoculation. The less common, but more fatal (35% if untreated), typhoidal form of tularaemia occurs after inhalation and presents with fever, anorexia and non-productive cough. Pneumonia may develop and can be

complicated by pleural effusions. Human-to-human spread is unusual and respiratory isolation is not required.

Diagnosis is established by isolation of the organism from sputum or blood. Treatment[56] is with streptomycin 30 mg kg^{-1} every 12 h i.m. for 10–14 days or gentamicin 3–5 mg kg^{-1} day^{-1} i.m. for 10–14 days. A live attenuated vaccine is available.[105]

Smallpox

In 1763, the British, under Sir Jeffrey Amherst, used smallpox in an attempt to eradicate hostile North American tribesmen: 'You will do well to try and inoculate the Indians by means of blankets, as well as to try every other method that can serve to extirpate this execrable race'.[90]

In 1980, the World Health Organization declared that smallpox had been eradicated. However, cessation of routine vaccination has increased the susceptibility of the population to variola infection.[15 60] Variola is highly infective (10–100 organisms cause infection) when aerosolized and stable when weaponized, and has a high mortality rate (3% in the vaccinated, 30% in the unvaccinated, death resulting mainly from bronchopneumonia) [53]. The variola virus is a member of the genus *Orthopoxvirus* (which includes cowpox and molluscum contagiosum), a group of large DNA viruses that can replicate in cell cytoplasm without the obligate presence of a host virus.

A prodrome of 7–17 days, during which the virus infects the upper and lower respiratory tracts and thoracic lymph nodes, is followed by prominent malaise, fever, headache and backache, rigors and delirium. Over the next few days, an erythematous rash appears about the face, hands and forearms.[80] During this time, the mucous membranes produce infectious secretions. After the rash has spread to the legs, it develops across the trunk over the next week and becomes more maculopapular, then pustular. The virus can be recovered from both pustules and the depressed scabs that form after pustule rupture; the patient is therefore infectious and requires isolation until the scabs have sloughed off. Contacts of the patient need to be isolated and vaccinated. The differential diagnosis of variola infection is wide, and includes chickenpox and contact dermatitis. Polymerase chain reaction analysis provides an accurate diagnosis.

Cidofovir, a DNA polymerase inhibitor used to treat cytomegalovirus in AIDS patients, appears to be effective *in vitro* when given early after infection. Ribavirin and Sandoglobulin may also be used.

Glanders

Glanders (farcy, equinia) is caused by *Burkholderia mallei*, a Gram-negative bacillus.[102] It is usually a disease of equines, but has been studied as a biological weapon by the USA and the USSR, the latter producing a weaponized form. The Germans were known to have deliberately contaminated livestock and animal feed in Romania, Mesopotamia and France during the First World War with *B. mallei* (and *Bacillus anthracis*). Aerosolization of *B. mallei* markedly increases its infectiousness. One to 10 organisms is sufficient to produce infection after inhalation. Acute and chronic forms exist. Several acute forms are recognized in humans.[23] The septicaemic form is manifested 10–14 days after exposure and is characterized by sudden onset of high fever, rigors and myalgia. Cervical lymphadenopathy and splenomegaly are seen. Leucopenia or leucocytosis may occur. Septic shock and MOF ensue rapidly, producing high fatality rates without treatment. The pulmonary form is common after inhalation. In addition to septicaemia, bilateral pneumonia and pulmonary nodular necrosis occur, with miliary shadowing seen on chest radiography. Oropharyngeal glanders infection produces a blood-streaked, mucopurulent discharge from the mouth, nose and eyes. Septal and turbinate nodules and ulcers are present. A cutaneous papular or pustular rash, similar to smallpox, may be seen. Chronic glanders produces persistent lymphadenopathy, multiple musculocutaneous abscess formation and oropharyngeal nodules. Treatment requires intensive organ support in combination with antibiotics, of which co-amoxiclav and sulfadiazine (30 mg kg^{-1} every 8 h for 3 weeks) appear to be the most effective. Doxycycline, rifampicin and ciprofloxacin are suggested for second-line use.[100] No human or animal vaccine exists.

Q fever, brucellosis and E. coli O157

Q fever[77 104] is caused by the rickettsial organism *Coxiella burnetti* and brucellosis by bacteria of the genus *Brucella* (particularly *B. suis*) [18]. *Escherichia coli* O157.H7 causes severe food poisoning.[44] All three organisms produce unpleasant symptoms and may cause fatalities, but their use as biological weapons is for the purpose of incapacitating a population or fighting force. Treatment rarely requires the involvement of anaesthetists or the use of intensive care facilities, and they are not therefore considered in this article.

Conclusions

Anaesthetists and intensivists routinely manage seriously ill patients. In addition, they possess detailed knowledge of pathophysiology and pharmacology. These factors make anaesthetists well prepared for dealing with the aftermath of a terrorist chemical or biological weapons attack. Nevertheless, it is important to re-emphasize certain aspects of clinical and logistical management. Every effort should be made to ensure the personal safety of anaesthetists, other staff and other patients. Inadequate personal protection reduces the efficiency and efficacy of the medical response. Exposure of anaesthetic staff to CBWs is minimized by decontamination before hospital admission, but those

anaesthetists who are part of a primary response team should be familiar with how to wear (and how to operate in) personal protective clothing and breathing apparatus. Decontamination is more effective against chemical weapon intoxication than biological weapon inoculation; it should be remembered that several of the biological agents are highly infectious, necessitating continued personal protection after hospital admission (including barrier nursing, prophylactic antibiotic administration and vaccination). Life-saving treatment, both of the effects of CBWs and of concomitant trauma, may be required for patients before they are decontaminated. Resuscitation may be difficult; there may be uncertainty as to which CBW has been used and lack of staff, drugs (antidotes and antibiotics) and facilities (particularly in view of the typical bed occupancy rate of casualty and intensive care units in the UK). Treatment may require prolonged ventilation and organ support in intensive care, decreasing the availability of this resource for other hospital patients.

Despite the alarming projected fatality statistics quoted for a significant chemical or biological weapon attack, mortality has historically been relatively low in instances of terrorist deployment of such weapons. Morbidity, however, has often been high, which in part reflects a lack of medical preparedness for such an event. There is increasing recognition that medical outcomes may be improved by implementation of specific CBW mass casualty procedures in conjunction with the dissemination of relevant information concerning clinical management. The information contained in this review will enable anaesthetists and intensivists to understand the pathophysiology associated with CBWs, in order to instigate appropriate therapy and rationalize available resources.

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Procedures

Procedures

University of Maryland

Emergency Management Plan

November 1999

Revised September 2002

EMERGENCY MANAGEMENT PLAN

I. Introduction

The University of Maryland, Baltimore (University) must be prepared for emergencies. Preparation for emergencies fulfills our responsibility to protect employees, students and visitors; fulfills regulatory requirements; enhances our ability to recover from disruptive events; reduces our risk exposure; and enhances our image with the local community, the state, and the nation.

The campus has had a history of responding to emergencies in a professional, effective manner; however, the responses have not been coordinated by a team involving all responsible units. An Emergency Preparedness Planning Team was formed to assess the University's current capabilities, develop a plan incorporating procedures for addressing emergencies, integrate the resultant Plan into University operations, develop strategies for training employees, and continually evaluate the emergency preparedness of the campus.

After September 11, 2001, like ever other college and university in the United States, the University of Maryland, Baltimore reviewed *its* ***Emergency Management Plan*** with a new sense of purpose. No longer were emergencies thought of in the abstract and there was a focused desire to ensure the campus community is as prepared as possible for all types of emergencies. The ***Emergency Management Plan*** that follows incorporates the latest thinking of the Emergency Preparedness Planning Team and it attempts to address the challenge of keeping this heightened awareness and commitment to emergency responsiveness going as time passes.

II. Purpose of the Plan

There are four goals implicit in the creation of the University's *Emergency Management Plan* (the "*Plan*" or "*this Plan*"): 1) to promote the safety and security of students, staff, faculty, and visitors; 2) to minimize damage to University resources; 3) to minimize disruption of University programs; and, 4) to assist the community as appropriate.

Numerous campus offices and departments have responsibility for emergencies. However, there must be a central emergency response and management team in place to: (1) facilitate coordination and communication among the offices and departments; (2) ensure necessary resources are available where and when needed as well as used and managed appropriately; and, (3) see that responses to emergencies are timely and appropriate.

This *Plan* provides campus-wide guidelines for preparing for and responding to emergencies. It is the responsibility of each school and unit to: (1) be aware of the

contents of this *Plan;* (2) work cooperatively with the Office of Environmental Health and Safety to develop emergency evacuation plans specific to its building(s) or spaces; and, (3) develop individual emergency plans that are consistent with this *Plan*. No part of these guidelines shall be construed as a contract between any employee, student, or visitor and the University. The University reserves the right to change any guideline at any time.

III. Definition of Emergency at the University of Maryland

An emergency is any unplanned event that can cause death or significant injury to employees, students, visitors to the campus, or the public; or that can shut down the campus, disrupt operations, or cause physical or environmental damage. The following events, as well as events not listed, may constitute an emergency:

- Fire/Explosion
- Hazardous Materials – Releases or Spills
- Acts of Terrorism
    - Bombs or Bomb Threats
    - Chemical Agent Releases
    - Biological Agent Releases
    - Incendiary Devices
    - Nuclear Devices/Releases
- Aircraft Accidents
- Suicide
- Workplace Violence
- Hostage Incidents
- Civil Disturbance
    - Animal Facilities Security Crisis
- Traffic Disruption
- Personnel Trapped in Elevator
- Floods
- Severe Weather/Natural Catastrophe
    - Hurricane/Tornado
    - Winter Storm
    - Earthquake
- Utility Failures
    - Natural Gas Leak/Supply Failure
    - Electric
    - Water Service
    - Steam
- Communication Failure

In this *Plan*, an emergency may be referred to as an "incident."

IV. Emergency Management Elements

A. Direction and Control

1. Emergency Management Team

An Emergency Management Team (the "Team") has been established to assume the responsibility for addressing emergencies on campus. The Team is headed by a director and is comprised of the following members:

Emergency Management Director ("EMD")
Assistant Vice President, Facilities Management

Team Members:
Vice President, Administration and Finance
Director, Environmental Health & Safety
Director, Operations & Maintenance
Director, Architecture, Engineering and Construction
AVP, OEA Communications and Publications
Director, Public Safety
Associate Vice President, Human Resources Services
AVP, Telecommunications, Information Technology
Director, Student and Employee Health
Director, Counseling Center
UMMS Liaison (as necessary)
VA Medical Center Liaison (as necessary)
University Physicians, Inc. Liaison (as necessary)
MIEMSS Liaison (as necessary)
Director, Media Relations (affected school as necessary)
Director, Parking and Commuter Services

The Team oversees the incident operations and supports the Incident Commander ("IC"), the person on-site who is in charge of the response to the emergency, by providing resources and recommending financial assistance, as needed. The Team will:

* Determine short and long term effects of an emergency.
* In consultation with the Incident Commander, order an evacuation or shutdown of a facility or system.
* Inform University administration and deans
* Mobilize University resources, as needed.
* Develop and implement a plan for the orderly return to normal operations.
* Interface with outside organizations and the media.
* Communicate situation reports to University students, faculty & staff.

* Provide Critical Incident Stress Debriefing ("CISD") for affected personnel.

Each Team member must designate an appropriate substitute in the event that he/she is not available or cannot be reached. Additional staff may be called upon to assist with the emergency response.

a. Emergency Management Director

The Emergency Management Director ("EMD") is in command and control of the Emergency Operations Center and the Team. The EMD will direct and coordinate the utilization of University resources and provide an interface with the City of Baltimore Emergency Operations Center, if it is activated. The EMD will coordinate with the Incident Commander to ensure the safest and most expedient mitigation for the incident. The EMD will keep the Vice Presidents, Deans, and the President informed as to the status of the emergency. The EMD will supervise distribution of emergency information for the campus through the Team members. The EMD will coordinate the development and implementation of a plan to restore normal operations to the campus.

In the event that the Assistant Vice President for Facilities Management is not available, the EMD responsibilities will be assumed by: (1) the Director of Operations and Maintenance, in the Office of Facilities Management, (2) the Director of Public Safety, or (3) the Director, Division of Environmental Health and Safety, in that order.

b. Incident Commander
(Varies, depending on nature of emergency)

The Incident Commander ("IC") is the person at the site of the emergency who is in charge of the immediate emergency response. The IC will be assigned to an emergency from the primary campus emergency management unit responsible for that emergency. This will vary depending on the nature of the emergency as summarized in the chart on pages 6 and 7. The identity of the IC may shift if the type of emergency changes on scene (i.e., an incident beginning with a Police IC could shift to a need for a medical IC.) The IC must have the capability and expertise to assume command of an emergency as described in this section.

The IC will manage the on-scene operations of an emergency response. The IC is responsible for the technical aspects of the response as well as the tactical planning and execution, determination of the need for outside assistance and resources, and interface with the Emergency Operations Center. During an incident, the IC will maintain regular communication with EMD.

The first emergency response person to arrive on the scene will become the IC and establish the incident command system. This person will remain in command until relieved by the designated IC. The IC, upon arrival, will assume command,

notify the EMD, implement the emergency procedures specified for the particular incident, assess the situation, implement this Plan, activate resources, order and initiate evacuation of persons in harm's way, and upon conclusion of the incident, declare the emergency over. In the event that the Baltimore City Fire Department is on scene at a fire, explosion or hazardous materials incident, the IC will act as the liaison with the Fire Department's Incident Commander.

2. Incident Command System

a. Emergency Response Levels

Emergencies can occur with varying degrees of severity that requires different levels of response and management. The following chart summarizes the levels of emergencies and types of response that may be required. The response classifications of emergencies parallels the definitions used by the Federal Emergency Management Agency, Maryland Emergency Management Agency and Baltimore City. This facilitates a clear understanding of the severity of an emergency and necessary response by all potential respondents.

LEVEL I LIMITED RESPONSE	LEVEL II INTERMEDIATE RESPONSE	LEVEL III FULL RESPONSE
Limited disruption of operations or services.	Intermediate disruption of operations or services.	Major or complete disruption of operations or services.
Limited or no evacuation. Limited to immediate area around incident.	Larger evacuation may involve entire floor or building.	Major evacuation involving multiple buildings or entire campus.
Small-scale incident such as lab spill that requires limited response of University Police, EHS, and Facilities Management. May or may not involve off campus resources.	Larger scale incident such as a hazardous materials spill or reported fire. Involves University Police, EHS and Facilities response with additional resources, such as the Baltimore City Fire Department.	Major incident involving most or all campus agencies and multiple off campus resources, such as Baltimore City Fire Department, Department of Environment, Baltimore City Police Department and others.
Injury to faculty, students, staff and/or visitors possible.	Injury to faculty, students, staff and/or visitors possible.	Injury to and/or death of faculty, students, staff and/or visitors likely.

b. Emergency Management Units

Responsibility for an emergency is assigned to a primary campus unit for incident command purposes. In addition, campus support units and outside agencies have been identified for each category of emergency.

EMERGENCY	PRIMARY UNIT	SUPPORT UNITS	OUTSIDE AGENCIES
Fires/Explosions	EHS (accidental) Public Safety (arson or incendiary)	OM; Tel; AE&C; Public Safety; CC; EHS	Baltimore City
Hazmat Incident	EHS	OM; Media Relations; Public Safety; Principal Investigator	Baltimore City; MDE; Contractor
Acts of Terrorism	Public Safety	EHS; Media Relations; OM; AE&C; Human Resources; CC	Baltimore City; State & Federal Agencies
Aircraft Accident	Public Safety	OM; EHS; Media Relations; AE & C; Shock Trauma; CC	Baltimore City; State & Federal Agencies
Suicide	Public Safety	CC	
Workplace Violence	Public Safety	Media Relations; Human Resources; CC	Baltimore City; State & Federal Agencies
Hostage Incidents	Public Safety	CC	
Civil Disturbance	Public Safety	Media Relations; Principal Investigator	City of Baltimore; State & Federal Agencies
Animal Facilities Security Crisis	Public Safety	OM; Media Relations; Veterinary Services; EHS	Baltimore City; Funding Agencies
Traffic	Public Safety	Public Affairs	Baltimore City
Personnel Trapped in Elevator	Public Safety	OM	Baltimore City Fire Department
Flood	OM	Public Safety; Media Relations; Principal Investigators; CC; EHS	Baltimore City; Contractor
Severe Weather/ Natural Catastrophe (snow, hurricane, tornadoes)	OM	Public Safety; Media Relations; AE &C; Human Resources; EHS; CC	Baltimore City; State & Federal Agencies
Utility Failures Contractors	OM	Public Safety; Tel	BG&E;
Communications Failure	Tel	OM; Public Safety; EHS; Media Relations	Bell Atlantic; Contractor

Key:

O M	Operations & Maintenance (Facilities Management)
EHS	Environmental Health & Safety
Tel	Telecommunications, CITS
AE & C	Architecture, Engineering & Construction (Facilities Management)
MDE	Maryland Department of the Environment
BG&E	Baltimore Gas & Electric
CC	Counseling Center

3. Emergency Notification and Management

a. Initial Notification – from Campus Telephones

CALL 711

It is the responsibility of every University student and employee to be aware of and to respond appropriately to both actual and potential emergency situations. All students and employees need to be instructed in the proper course of action regarding the process of notification for any emergency. While specific campus units may have procedures for emergency situations that are unique to their particular areas, **a campus emergency should be reported to the University Police by calling 711. From non-campus telephones use 410-706-3333.**

Emergency situations regarding building services, such as loss of power, heat, or communications also should be reported to Work Control by calling 6-7570.

b. Assessment and Response

Following a call to 711 of an actual or potential emergency on campus, the University Police will notify the Primary Emergency Management Unit (see pages 6 and 7). Together with the Primary Emergency Management Unit, the University Police will respond to the scene of the emergency. Upon arrival at the scene of the emergency, the University Police and the Primary Emergency Management Unit will provide an initial assessment and an appropriate incident level will be determined. The IC will be identified by the Primary Emergency Management Unit contact as well.

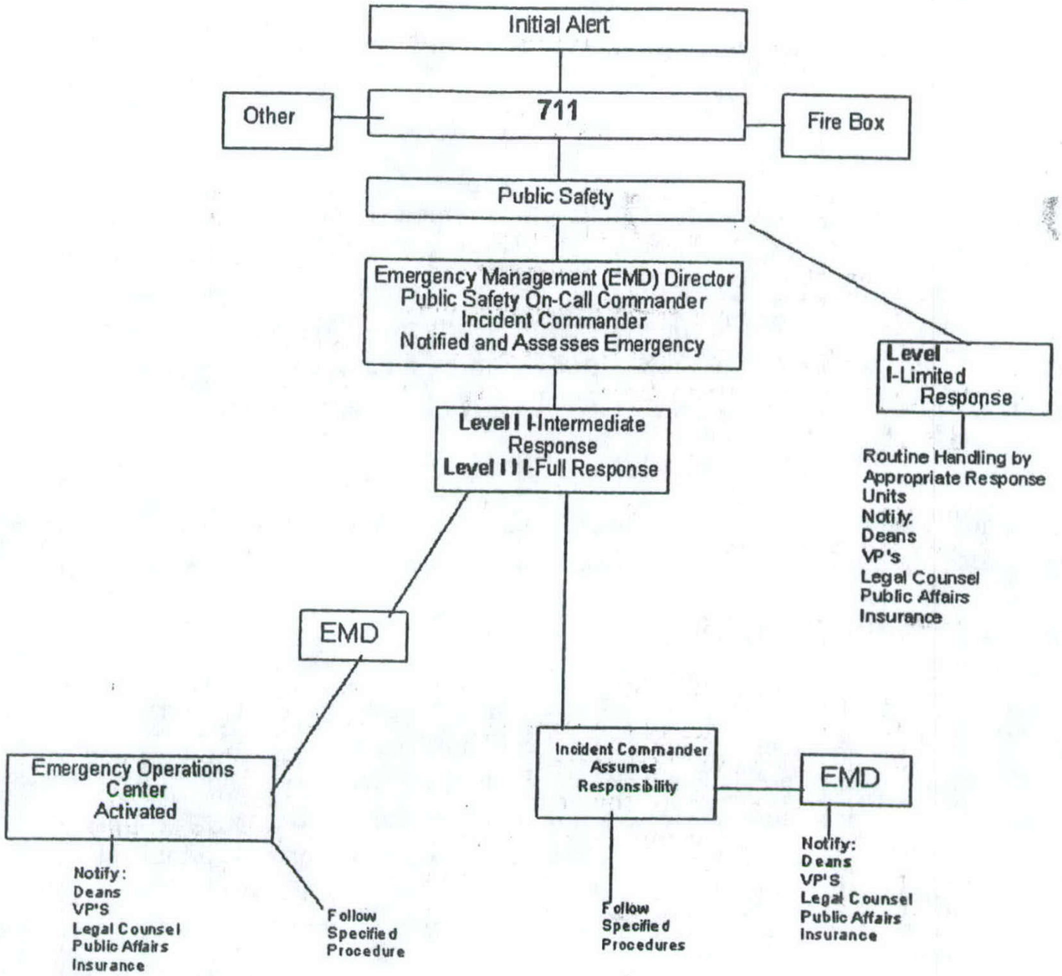
The University Police will notify the EMD of all emergencies. If the emergency is potentially a Level III incident or severe Level II incident, the EMD will report to the emergency scene, assess the situation and coordinate the necessary response in consultation with the University Police and on-scene Incident Commander. In the event that the emergency requires a full-scale response, the EMD will instruct the University Police to notify the entire Team for mobilization. The Team will report to the Emergency Operations Center to develop an operational plan to mitigate the emergency.

It is the responsibility of all Team members, with the consultation of the IC; to determine the resources needed from their particular units or functions.

A complete list of all contact information for Team members and substitutes will be in the possession of the EMD at all times. The University Police, Team members, the Vice President for Administration and Finance, and the President's Office will have a copy of this list as well.

c

NOTIFICATION PROCESS



4. Emergency Operations Center

PEARL STREET GARAGE TECH ROOM

The Pearl Street Garage Tech Room, located at 660 West Pearl Street, has been designated as the Emergency Operations Center for the campus. In the event that the Pearl Street Garage is involved in the emergency, or is otherwise unavailable, the Pine Street Police Station, located at 214 North Pine Street, will function as the back up Emergency Operations Center for the campus.

Each Operations Center will have copies of all Campus emergency manuals and information documents, including (note: unit responsible for providing document and ensuring it is current, is indicated in parentheses) :

- Emergency Management Plan (EMD)
- List of Team members and designated substitutes with telephone and other contact numbers.(EMD)
- List of key University personnel by school and unit with corresponding telephone, email, fax and other communication information.(EMD)
- Building evacuation plans.(EH&S)
- Comprehensive list of all University faculty, employees, and staff, with pertinent information, including individuals with special needs.(Public Safety)
- Floor plans of all Campus-owned and/or occupied buildings.(FM)
- Current Campus Telephone Directory, plus white and yellow pages phone books.(EMD)
- Directory of campus-wide email addresses and fax numbers.(AVP Communications)
- List of home telephone numbers of key University personnel.(Public Safety)
- Computer disks containing important departmental information that will be needed during an emergency (i.e. media phone numbers). The disks must be compatible with the computer software in use at the Operations Centers.(AVP,OEA)
- Telephone and/or other contact numbers for area neighborhood association presidents and facility managers.(AVP,OEA)
- List of campus radio frequencies and personnel radio designations.(EMD)

The EMD will assume responsibility for seeing that this information is updated on an annual basis.

The Operations and Maintenance Department and the Department of Public Safety will ensure that adequate supplies are available for the Emergency Operations Centers and

will update those supplies periodically. The supplies list will be developed by the Emergency Management Team and reviewed on an annual basis.

Cable TV, voice and data lines as well as two-way radios are available in the Emergency Operations Center.

B. Communications

1. Internal

Communications internal to the campus must reflect the decentralized nature of the campus communications infrastructure and the limited access to several of the mediums. Not every student or employee has access to voice mail, e-mail or telephones.

Key to successful internal communication, is the realization is that there are at least 12 entities, the President's Office, five vice presidential units and six schools, that need to assume responsibility for internal communications within their respective unit or school.

There are two levels of communication that require different methodologies for disseminating information during emergencies. Status reports from the Emergency Management Team, once it has convened and is working on an emergency situation, require one level of notification. Action messages, requiring campus-wide distribution (i.e. Campus is under liberal leave policy), require a different level of notification.

a. Status Reports

A member of the Emergency Management Team will notify the Vice President for Administration and Finance and the President's Office that the Emergency Operation Center has been activated. A status report will be provided to the President and Vice President for Administration and Finance. The designated person in the President's Office will notify the schools and other major campus units as to the status of the emergency. At that time, the schools and major units (12), in addition to UMMS, UPI, UMBI, and the VAMC, have the prerogative to send a representative to the Emergency Operations Center to observe the activities and report back to their schools/units.

As a backup methodology, status updates on the emergency will be distributed to the major units via email and voice mail. Distribution lists have been created for the major unit contacts and their backups.

b. Action Messages

A member of the Emergency Management Team will prepare a message pertaining to the emergency for distribution to the campus community. Prior to its release, the message will be reviewed and approved by the President's Office. Once approved, OEA will provide it to the schools and units. OEA, as part of the Emergency Management Team, is

the unit responsible for campus-wide distribution of the approved message using broadcast Voice Mail (reaches approximately 60% of the campus population). Fire Wardens also will be used to notify staff in each building. Finally, OEA will post the approved message on the emergency telephone number Ext. 68622 (formerly, snow or inclement weather number), campus Web site, and other formats, as necessary.

c. School/Unit Responsibility

Each School and administrative unit must develop a method for distributing information concerning emergency status reports and action messages to its students and staff. Access to staff and student location and home phone numbers also is the responsibility of each School and unit.

d. Emergency Operations Center

Cable TV, voice and data lines as well as two way radios are available in the Emergency Operations Center. A Communications Checklist has been developed for used by the Incident Commander and/or Emergency Management Director.

e. Two way Radios

There are 15 two-way radios available for use by the Emergency Management Team during emergencies. Channel 1 will be the primary channel for emergency communications, with channels 3, 4 and 5 functioning as the back up channels.

f. Fire Wardens

The following is the University Fire Warden Emergency Notification Procedure:

I. Purpose. The purpose of this document is to establish procedures to notify the campus community of the status of an ongoing campus, city, state, or national emergency.

II. Responsibilities.
   a. Schools and other University Business Units
      i. Upon request, provide the Office of Environmental Health and Safety the names of individuals that will act as fire wardens for their respective facilities.
      ii. Provide reasonable time for fire wardens to attend training and participate in other emergency preparation activities.
   b. Office of Environmental Health and Safety
      i. Maintain an up-to-date list of all campus fire wardens, their location, and additional personal information.
      ii. Maintain an up-to-date Fire Warden Calling Tree.
      iii. Coordinate and provide training on the University's Fire Warden Notification Procedure.

iv. Develop and periodically update the University Fire Warden Notification Procedure.
v. Coordinate periodic testing of the Fire Warden Emergency Notification Procedure.

c. Fire Wardens
   i. Attend training held by the Office of Environmental Health and Safety.
   ii. Notify the Office of Environmental Health and Safety of any changes in their personal information, transfers to different work areas, or departure from University services.

III. Fire Warden Notification Procedures

a. In the event of an emergency, the University Emergency Management Team shall prepare periodic emergency information updates. These updates will be posted on the University's Web Page (http://www.umaryland.edu). The updates will also be available on the Emergency Information Line at 410-706-8622.
b. Fire Wardens shall be notified of the fact that an emergency condition exists via the Fire Warden Calling Tree. Fire wardens will be directed to obtain information about the emergency situation via the University web page or the Emergency Information Line. Fire Wardens will continue to monitor these sources for additional updates concerning the emergency until the emergency is declared over.
c. In the event that the University's website is down, fire wardens shall assemble in the first floor lobby area of their building. They will get up-to-date information about the emergency condition from the security guard for their building. If their building does not have a security guard, a representative of the group will walk to the nearest building with a security guard and obtain an information update.
d. Upon receipt of an emergency information update, fire wardens will report this information to the most senior member of University management in their area of responsibility and shall then assist management in notifying the other employees in their area.
e. Fire Wardens shall report any additional information they may discover that is relevant to the emergency condition to a security guard for forwarding to the incident commander and/or emergency operations center.

2. External

a. Public Information

During an emergency on campus, communication with the outside world is the responsibility of the AVP for Communications and Publications. In consultation with the EMD, he/she will coordinate all news releases, interviews, and information dissemination concerning the emergency. The AVP for Communications and Publications will send a

media relations representative to the scene and will personally report to the active Emergency Operations Center.

In the event of a large-scale emergency, and as designated by the AVP Communications and Publications, media briefings will be held in the Terrace Lounge of the Student Union or Room 101 of the Pharmacy School, depending on the location of the emergency, availability of the space, and the Emergency Operations Center in use.

During an emergency that requires the activation of the Team, necessary telephone calls will be re-routed from the offices of the Team members to the Emergency Operations Center. This will be the responsibility of the AVP for Communications and Academic Affairs, or his/her designee.

It is the responsibility of the AVP of Communications and Publications to arrange for communications with the residents and businesses of the communities surrounding the campus, if those homes and businesses may be impacted by the campus emergency. This will be accomplished through discussions with the Neighborhood Association presidents, building managers and affected business representatives during the course of the emergency.

b. Official University Spokesperson

When the University encounters a situation where the media wants details about an emergency that involves the University, its students, faculty and staff, it is important the media clearly understand the situation. The situation may be on-campus and require implementation of the Emergency Management Plan or off-campus, involving students, faculty or employees.

Within this range of situations, the AVP of Communications and Publications will arrange for an official spokesperson for the University. The Media Relations staff is responsible for working with the media and is best suited to supervise the explanation of the situation and how it impacts the University.

c. Media Relations Responsibilities

It is not always easy to recognize what type of situation may be of interest to the media or might generate extensive media coverage. Criteria might include an impact on a large number of people, the use of emergency vehicles and personnel (news people monitor radio scanners and follow up with questions) or the impact on the safety and well being of the campus and surrounding community.

If the Office of Public Safety is involved (and it should be in most of these situations), it will take responsibility for informing the AVP of Communications and Publications of the incident. If the AVP cannot be contacted, the University Police will use the Office of Media Relations telephone calling tree to contact other members of the Office and

communicate pertinent information. A determination as to what type of announcement is necessary will be made between the Office of Media Relations, University Administration, University Counsel and the office(s) involved in the incident. When the reputation of the University is an issue in regard to the incident or crisis, statements will be cleared with the Office of the President or his designee.

The AVP for Communications and Publications or an alternate will be the liaison for all distribution of information to media and other public groups, internal and external.

It is the responsibility of the Media Relations Office to gather the necessary information to draft the statements. This may include the collection of information from non-campus sources when necessary such as local or state police, Baltimore City Fire Department, UMMS, States Attorney or others. The Office of Media Relations will be responsible for contacting the appropriate individuals in the Office of External Affairs and for coordinating any response to subsequent inquiries from the media.

Reporters may call and seek commentary from those who have been involved in incidents. It is the University's policy that departmental supervisors involved in the emergency may respond to media inquiries following consultation with the Office of Media Relations for assistance in answering the questions.

d. UMMS, VA and MIEMSS Notification

The EMD will notify the designated UMMS, VAMC and/or MIEMSS representatives in the event of an emergency. If the Emergency Operations Center is activated, and if the emergency has potential implications for UMMS, VAMC or MIEMSS, the designated representative will be asked to join the Team at the Emergency Operations Center.

C. Counseling Center

It is often difficult to determine in advance whether an incident is likely to cause an adverse psychological reaction for those immediately involved. The Incident Commander should notify the Counseling Center Director of all Level II and III incidents to jointly determine whether the Counseling Center should assess the need for service. The Counseling Center will provide Critical Incident Stress Debriefing (CISD) and psychological support services to students, faculty and staff who suffer or are at risk of psychological distress during or after an incident. Services provided may include: provision of CISD for victims, responders, and others secondarily affected by the incident; assistance in obtaining needing resources for victims; consultation with Media Relations regarding internal and external communications; provision of liaison services to student affairs officers and psychological responders from other parts of the campus community; ongoing individual, family, and group counseling in the recovery and restoration period.

Critical Incident Stress Debriefing services may be provided at the site of an emergency, if there is a secure location available, or at another location. Services may include

defusing on-site, or individual or group off-site debriefing activities. Defusing may occur while the incident is still in progress and debriefings may continue until appropriate stabilization has occurred.

D. Public Protection Options

The methods of providing initial public protection during an emergency are evacuation and in-place sheltering. Choosing the proper method depends on the circumstances associated with the hazard and the expected duration of the emergency. Evacuation involves moving people from harm's way to a place of safety. It must be determined if the threatened population can be evacuated safely. In some cases evacuation can cause people to be unduly exposed to unhealthy levels of contamination. Other difficulties may include ability to notify evacuees, identification of safe relocation sites, and availability of resources including available personnel to assist with the evacuation procedures. See Appendix A for model Fire Evacuation Plan.

In-place sheltering can be an effective public protection option for short duration emergencies (2-hours or less) where exposing people to contamination is a concern. This may be the only alternative if an entire area is cloaked in a vapor or gas cloud. If however, there is a danger of fire or explosion, then sheltering in-place is not an option. Sheltering in-place in University buildings will require close coordination between facilities management and building personnel. Some education of personnel will be needed so they understand the concept of sheltering in-place.

E. Property Protection

1. Mitigation

The University through a series of "on call" contracts with qualified vendors has the ability to utilize the services of any or all of the contractors to mitigate the losses to and secure from further peril all University property. The appropriate Facilities Management personnel on the scene are authorized to call in the appropriate "on call" contractors in an emergency situation to mitigate the damages and secure the facility. Facilities Management will immediately notify Environmental Health and Safety to advise Risk Management of all insurance matters including necessary procurement activity. Risk Management will contact the Insurance Division, State Treasurer's Office for approval of the emergency repairs as well as for appropriate post-incident clean up, restoration, and repairs that may be needed.

2. Facility Shutdown

Any facility or part of a facility that is sufficiently damaged as to be unsafe for use by University employees can be shutdown. During this period the Team, in consultation with Facilities Management will assess the damage and the need for remediation,

restoration, and/or repairs that will be required. If it is deemed necessary, the facility (in whole or in part) will remain closed for an additional period of time.

University Police will be responsible for enforcing the facility closure order until such time as it is modified or revoked. A control plan for allowing appropriate University and contractor personnel into the affected facility will be developed and implemented by Facilities Management in consultation with the facility user(s), University Police, Environmental Health Safety, and Procurement.

3. Records Preservation

Any University records that are damaged as a result of an emergency will be secured by Facilities Management until such time as an approved records recovery contractor can take possession of them. Use of contractors of this type must be approved by both Risk Management and the Office of Procurement to ensure compliance with applicable state regulations and guidelines. Emergency measures to minimize damage may be taken by the authorized Facilities Management personnel on site.

F. Recovery and Restoration

1. Planning Decisions

The Emergency Management Team will be required to assemble a Recovery/Restoration team to coordinate the planning for the rehabilitation of the damaged facility for use and occupancy by University employees. At a minimum the Recovery/Restoration Team should consist of representatives from Facilities Management AEC and OM, Environmental Health and Safety – Risk Management, Procurement, affected facility user(s), and University Police.

2. Risk Management (Insurance)

To ensure that insurance recoveries for damage to University property (facilities, equipment, supplies, furniture, and vehicles) are maximized, Risk Management must be involved prior to any non-emergency repairs/mitigation work. All claims must be processed through Risk Management to the Insurance Division of the State Treasurer's Office for approval. All procurement activity for services, repairs, remediation, and replacement of damaged goods must be approved in advance by Risk Management. Procurement activity will be conducted in accordance with all appropriate and applicable state/university regulations governing such activity by the Office of Procurement Services.

All invoices for procurement activity approved by the Insurance Division must be routed through Risk Management for payment by the State of Maryland. Invoices mistakenly paid by the University cannot be reimbursed.

There is no reimbursement for the time of any University employee working on repair, remediation, mitigation, or clean up of an emergency situation unless it can be clearly documented that such labor was provided on an overtime basis.

All claim forms and instructions are available from the EHS web page under Risk Management-Insurance Programs section or from the EHS Office.

3. Critical Incident Stress Debriefing (CISD)

The University of Maryland Counseling Center's protocol for CISD is attached as Appendix B.

V. Training and Implementation

A. Emergency Drills

Periodically, emergency drills need to be conducted to assess the University's ability to respond to a real emergency as well as to educate the Team and the campus community. The following guidelines have been established for emergency drills:

1. Drills should always have written objectives.
2. Drills must be clearly identified as such during all communications as well as at the site.
3. Drills will be coordinated in advance with the Office of Media Relations.
4. Training and orientation sessions will be held prior to actual drills.
5. Drill formats will be realistic.
6. Participants' safety always comes before exercise objectives.
7. All participants need to be easily identified.
8. Appropriate equipment, personnel and supplies must be present.
9. One person must be assigned responsibility for the drills. He/she must be clearly identified and have the authority to stop the drill if necessary.
10. A debriefing session should be held after the exercise.

The Team will meet periodically to set training and drill objectives for the year. Broad parameters for drills should be developed and communicated to Environmental Health and Safety for design and implementation.

B. Training

Incident Commander and Emergency Operations Center/Incident Commander interface training will be provided to all Team members and potential Incident Commanders. Additionally, potential Incident Commanders will receive hazardous materials awareness, operations and incident command training. Public Safety, Environmental Health and Safety, and Facilities Management, as

Primary Units, will receive hazardous materials awareness training. Other training will be provided as determined by the Team and State and Federal regulations. EHS will coordinate development, delivery, records, and refreshers for appropriate emergency response training.

C. Implementation

This Emergency Preparedness Plan will be effective immediately and must be communicated to the Campus community.

VI. Emergency Response Procedures

A. Fire/Explosion

1. Responsibilities:

EHS oversees the protection of life and property from fire on campus. Under the State of Maryland Fire Prevention Code, BOCA Fire Prevention Code and National Fire Protection Association Life Safety Code, the Senior University Fire Protection Specialist is designated as the Campus Fire Code Official. The Fire Code Official, with the assistance of other EHS personnel, conducts fire safety inspections and public education programs, trains fire wardens, provides fire safety orientation training for all new employees, reviews plans for new construction and renovation, develops fire evacuation plans for all campus buildings, conducts fire drills, provides consultation on all issues involving fire safety, and coordinates fire safety issues with the State Fire Marshall and the Baltimore City Fire Department. Additionally, the Fire Code Official is responsible for investigating fires to determine their cause. If the investigation determines that the fire was arson or an incendiary device was used, the University Police will take charge of the investigation and will determine whether outside agencies will be used.

EHS personnel will respond to all fire alarms on campus during business hours to determine the cause of the alarm or fire emergency, and to assist the Baltimore City Fire Department in any way possible. EHS will respond to all fires regardless of the time or day.

Upon receipt of an automatic alarm or notification from the public of a fire condition, the Department of Public Safety will notify the Baltimore City Fire Department, EHS and Facilities Management, Operations and Maintenance Department. Police officers will be dispatched to provide access for the Fire Department to the building(s) where the fire incident is occurring, control traffic and evacuees, and assist Fire Department and EHS personnel, as needed. After the fire is extinguished, the Department of Public Safety will conduct the investigation of any suspicious fires or explosions.

2. Fire Notification Procedures:

The individual who recognizes a fire or potential fire will:

a. Alert all individuals who might be harmed by the fire to evacuate the immediate area and withdraw to a location that will not impede emergency personnel.

b. Activate the building fire alarm system.

c. Dial extension 711 on a University telephone located a safe distance from the hazard to report the nature of the incident, the exact location, whether there are any injuries, and any other details that will assist officials in preparing the response.

Public Safety will:

a. Summon the Baltimore City Fire Department

b. Dispatch officers to the scene to:

   1) direct building evacuees away from the front of the building to make way for emergency response personnel.

   2) assist EHS and the fire department as needed.

   3) provide communications between the fire department and other University departments for needed resources.

c. Contact EHS; during business hours, call 410-706-3490 (6-3490). After hours, activate the emergency beeper number (410-407-0486).

d. Contact OM at 6-7570.

e. Contact the Counseling Center to initiate the CISD protocol.

EHS will:

a. Provide the liaison with Baltimore City Fire Department incident commander.

b. Determine, with OM electronic technicians, the cause of alarm activation.

c. Follow-up to mitigate false alarms, when possible.

d. Coordinate fire evacuation with building fire wardens and the evacuation supervisor during normal work hours.

e. Collaborate with University Police to conduct fire cause investigations.

Operations and Maintenance will:

a. Respond with keys to building(s) and rooms where the fire incident is occurring.

b. Provide radio communications as required.

c. Assist EHS, the fire department and other as needed.

d. Coordinate clean up and notify EHS Risk Management for insurance purposes.

e. After the emergency is over, reset alarm system and replace system components as needed to restore to full working order.

B. Hazardous Materials Incident

1. **Purpose:** These procedures outline the emergency action steps to be taken in the event of any incident involving hazardous materials (HAZMAT). Types of incidents include, but are not limited to: indoor and outdoor fuel spills; solvent or other chemical spills in shops; chemical or biological spills in buildings and laboratories; chemical odors in buildings; natural gas smells and leaks; chemical and biological terrorism incidents; and fires in a laboratory or other facility involving highly toxic chemicals, infectious substances or radioactive materials. The common thread for response to all HAZMAT incidents is continual evaluation and the involvement of appropriate resources.

2. **Responsibilities:** Incidents will be categorized according to the seriousness and level of response required. The following levels are in accordance with standard emergency response terminology and will be used to identify the University Hazardous Materials Response.

   Level I Incidents: Limited Response incidents, requiring minimal resources, which can usually be handled by the person causing the spill with or without consultation from EHS. It is the responsibility of the user of hazardous materials to be knowledgeable of the risks involved in their use and to be prepared to react appropriately to Level I incidents without additional assistance. The University of Maryland, Baltimore Hazard Communication Program, the Chemical Hygiene Program, and the Radiation Safety Program outline the mechanisms and resources for ensuring that faculty, staff, and students achieve this level of preparedness. Nonetheless, unforeseeable events can result in a HAZMAT incident that can be solved without risk of personal injury. Such an event should be considered a major incident requiring activation of the procedures described below.

   Level II Incidents: Intermediate Response incidents that can be handled by the EHS HAZMAT Response Team. These incidents involve materials that can be addressed with Level B Chemical Protective clothing. EHS personnel will determine the level of protective clothing required upon arrival at the incident scene. Other campus departments may or may not be involved as determined by the response team.

   Level III Incidents: Full Response incidents that may involve multiple University departments and off campus resources in addition to EHS. Upon arrival at the incident scene EHS personnel will confirm the incident level and request appropriate resources. This level of incident would require the activation of the Emergency Response Center. EHS has primary responsibility for the resolution of HAZMAT incidents. The Offices of

Public Safety, Operations and Maintenance, Public Affairs, and Insurance can be expected to provide supporting roles. EHS may all upon city and State agencies such as the Baltimore City Fire Department (BCFD) and the Maryland Department of the Environment (MDE) for assistance. BGE may be contacted for natural gas leaks.

3. Procedures:

The individual who recognizes a major HAZMAT incident will:

a. Alert all individuals who might be harmed by the material to evacuate the immediate area and withdraw to a location that will not impede emergency personnel.

b. If safe to do so, limit the spread of the material by applying absorbent and shutting doors.

c. Dial extension 711 on a University telephone located a safe distance from the hazard. Report the nature of the incident, the exact location, whether or not there are any injuries, and any other details that would assist officials in preparing their response.

Public Safety will:

a. Summon appropriate emergency units if injuries have been reported.

b. Contact EHS during business hours dial 410-706-3490 (6-3490). After hours activate the emergency beeper number (410-909-0381).

c. Dispatch officers to the scene who will:

   1) Take appropriate actions as HAZMAT First Responders, secure the area, deny entry, and establish incident command.

   2) Assist with evacuation.

   3) Assist EHS to clear the situation.

EHS will:

a. Form an appropriate response team and proceed to the site. The Incident Commander will decide who to include on the response team such as, the Baltimore City Fire Department Hazardous Materials Team, Maryland Department of the Environment, or a private contractor.

b. Assume incident command and execute site management and control.

c. Provide an incident safety officer.

d. Identify the materials involved.

e. Perform a hazard risk analysis.

f. Determine level of personal protective equipment needed to effect clean up. If Level A protection is required, request notification of Baltimore City Fire Department; or for less urgent matters, call for commercial clean up services.

g. Perform clean up.

h. Decontaminate personnel and equipment.

i. Terminate the incident.

j. Conduct critique and follow-up.

k. Provide Risk Management services, if appropriate, for coordination of insurance activities.

Facilities Management will:

a. Provide support to EHS such as mechanical systems control and equipment and supplies, as needed.

C. Acts of Terrorism

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a terrorist threat or attack.

2. **Primary Responsible Unit**: The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Unit**: The secondary responsible units are Facilities Management (FM), Environmental Health and Safety (EHS), Media Relations, and the Counseling Center.

4. **Employee Responsibility**:

   a. Leave the area, notify Public Safety (ext. 711) and notify supervisor.

   b. Report any suspicious activity to Public Safety and to supervisor.

   c. Explain the situation in as much detail as possible to Public Safety.

   d. Assist with evacuation procedures if necessary.

   e. Stay available for debriefing purposes.

   f. Assist with accounting for personnel.

5. **Police and Procedure Overview:** If a Terrorist situation occurs, Public Safety will:

   a. Dispatch officers to the scene.

   b. Notify Baltimore City Police, request Fire Department and Emergency Medical Assistance.

   c. Notify FM, EHS and Media Relations.

   d. Determine whether evacuation of the area is required.

   e. Assist with evacuation procedures if necessary.

   f. Contact the Counseling Center to initiate the CISD protocol.

The officers will:

a. Respond to the scene and assess the situation.

b. Call for additional officers if necessary.

c. Form a protective or restrictive cordon around the area of interest.

d. Establish a field command post.

e. Coordinate and direct the arrival of Baltimore City Fire and Police Department's personnel.

f. If possible, neutralize the situation and make an arrest.

g. The Emergency Operations Center may or may not be activated depending upon the seriousness of the incident.

6. **Campus Resources**: The following campus resources are available to assist with a terrorist situation:

   a. Office of Public Safety

   b. Office of Facilities Management

   c. Office of Environmental Health Safety

   d. Office Media Relations

   e. Office of the Counseling Center

7. **External Resources:** The following external resources are available to assist with a terrorist situation.

   a. Baltimore City Fire Department

   b. Baltimore City Police Department

   c. Federal Bureau of Investigation, and other Federal agencies

   d. State Police and National Guard

   e. Medical Examiner's Office

D. Aircraft Accident Emergency Procedures

1. **Purpose** of this procedure is to provide guidance regarding the response to and recovery from an aircraft accident on campus.

2. **Primary Responsible Unit**: The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Units**: The secondary responsible units are the Office of Environmental Health and Safety (EHS), Facilities Management, Media Relations, Shock Trauma, and the Counseling Center.

4. **Employee Responsibility:** The employee(s) will:

   a. Sound the alarm to evacuate the area, if appropriate.

   b. Call 711

   c. Assist with the accounting of personnel.

   d. Evacuate the affected area.

5. **Policy and Procedures Overview**: If an aircraft accident occurs on campus

   a. Public Safety will:

      1) Call Baltimore City Fire Department.

      2) Dispatch officers to scene.

      3) Call Work Control and EHS.

      4) Call Emergency Management Director.

      5) Notify Federal Aviation Administration.

      6) Contact the Counseling Center to initiate the CISD protocol.

   b. Officers will:

      1) Respond to the scene and assess the situation.

      2) Call for additional officers, if necessary.

3) Assist with evacuation if it is safe to do so.

4) Assist Fire Department and control traffic.

5) Form a protective or restrictive cordon around the area of concern.

6) Assist external resources to clear the area.

c. Fire Department will:

1) Take control of the scene.

2) Evacuate casualties.

3) Eliminate fire hazards.

4) Assess damage to property and determine if property can be used in its condition.

5) Give the "ALL CLEAR" command when the fire or hazard has been neutralized.

d. Emergency Operations Center may be activated depending upon the severity of the incident.

6. **Campus Resources:** The following campus resources are available to assist with an aircraft accident:

a. Office of Public Safety

b. Office of Facilities Management

c. Office of Environmental Health and Safety

d. Shock Trauma

e. Emergency Management Team

7. **External Resources:** The following external resources are available to assist with an aircraft accident

a. Baltimore city Fire Department

b. Baltimore city Police Department

c. Surrounding county fire Departments

d. State Agencies

e. Federal Aviation Administration

E. Suicide

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a suicide situation.

2. **Primary Responsible Unit:** The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Units:** The secondary responsible units are Facilities Management (FM), Media Relations, and the Counseling Center.

4. **Employee Responsibility:**

   Employees will:

   a. Notify Public Safety (ext. 711) and notify their supervisor.

   b. Remain at the scene for debriefing purposes.

5. **Policy and Procedure Overview:** If an attempt or actual suicide occurs:

   a. Public Safety will:

      1) Dispatch officers to the scene.

      2) Notify Baltimore City Police.

      3) Request Emergency Medical Assistance.

      4) Notify FM and Media Relations.

      5) Activate Public Safety's emergency operations plan.

      6) Evacuate the area if necessary.

      7) Notify immediate family.

      8) Contact the Counseling Center to initiate the CISD protocol.

   b. The Officers will:

      1) Respond to the scene and assess the situation.

      2) Call for additional officers if necessary.

3) Form a protective or restrictive cordon around the area of interest.

4) Establish a field command post.

5) Coordinate and direct the arrival of Baltimore City Police Department personnel and ambulance services.

c. The Emergency Operations Center may or may not be activated depending upon the seriousness of the incident.

6. **Campus Resources:** The following campus resources are available to assist with a suicide:

   a. Office of Public Safety

   b. Office of Facilities Management

   c. Environmental Health and Safety

   d. Media Relations

   e. Counseling Center

7. **External Resources:** The following external resources are available to assist with a Suicide:

   a. Baltimore City Police Department

   b. Baltimore City Ambulance Services

   c. Medical Examiner's Office

F. Workplace Violence

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a situation regarding workplace violence or threat of workplace violence.

2. **Primary Responsible Unit:** The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Unit:** The secondary responsible units are Media Relations, Campus Health, and the Counseling Center.

4. **Employee Responsibility:**

   Employee will:

   a. Leave the area, call Public Safety (ext.711) and notify supervisor.

   b. Report any behavior witnessed which they regard as threatening or violent.

   c. If necessary, obtain a warrant or a protective/restraining order that lists UMB being a protected area.

   d. Provide a copy of the order or the number assigned to the warrant to Public Safety and the supervisor.

5. Policy and Procedure Overview: If a workplace violence situation or threat of workplace violence occurs:

   a. Public Safety will:

      1) Dispatch officer to the scene.

      2) Call Baltimore City Police for additional assistance, if necessary.

      3) Call Media Relations, if necessary.

      4) Establish Field Command Post, if necessary.

      5) Make security recommendations to employee(s) and management.

      6) If warranted, provide increased police protection in the area.

      7) Assist victims to obtain the appropriate legal remedy.

b. The Emergency Operations Center may or may not be activated depending upon the seriousness of the situation.

c. The Officers will:

1) Respond to the scene, assess the situation and/or investigate the complaint.

2) Assist the victim(s) and call for medical assistance, if necessary.

3) Call for additional officers if necessary.

4) Form a protective or restrictive cordon around the area of interest.

5) Counsel victim(s) or potential victims about the various civil and criminal options available.

6) Warn any person making threat (if available) about legal ramifications.

7) Arrest the suspect, if appropriate and/or possible.

8) Refer the victim(s) to the Counseling Center.

6. **Campus Resources:** The following campus resources are available:

a. Office of Public Safety

b. Counseling Center

c. Campus Health

d. Media Relations

7. **External Resources:** The following external resources are available:

a. Baltimore City Police Department

b. State and Federal Agencies

G. Hostage Incidents

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a Hostage or Barricade situation.

2. **Primary Responsible Unit:** The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Units:** The secondary responsible units are Facilities Management (FM), Media Relations, Telecommunications Services, and the Counseling Center.

4. Employee Responsibility:

   a. Leave the area, notify Public Safety (ext. 711) and notify supervisor.

   b. Report any suspicious activity to Public Safety and to supervisors.

   c. Stay available for debriefing purposes.

   d. Assist with accounting for personnel.

   e. Assist with evacuation procedures if necessary.

5. **Policy and Procedure Overview:** If a hostage or barricade situation occurs:

   a. Public Safety will:

      1) Dispatch officers to the scene.

      2) Notify Baltimore City Police; request Emergency Medical Assistance and Fire Department.

      3) Activate Public Safety's emergency operations plan.

      4) Evacuate the area.

      5) Contact the Counseling Center to initiate the CISD protocol.

   b. The officers will:

      1) Respond to the scene and assess the situation.

      2) Call for additional officers, if necessary.

3) Form a protective or restrictive cordon around the area of interest.

4) Establish a field command post.

5) Coordinate and direct the arrival of Baltimore Police Department personnel.

6) Establish communications with suspects.

7) Neutralize the situation and make an arrest, if possible.

c. Emergency Operations Center may or may not be activated depending upon the seriousness of the incident.

6. **Campus Resources:** The following campus resources are available to assist with a hostage or barricade situation.

a. Office of Public Safety

b. Office of Facilities Management

c. Office of Telecommunications Services

d. Office of Media Relations

e. Office of the Counseling Center

7. **External Resources:** The following external resources are available to assist with a hostage or barricade situation.

a. Baltimore City Fire Department

b. Baltimore City Police Department

c. State Police

d. Medical Examiner's Office

H. Civil Disturbance / Animal Facilities Security Crisis

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a civil disturbance or animal facility security issue.

2. **Primary Responsible Unit:** The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Units:** The secondary responsible units are Environmental Health and Safety, Facilities Management and Media Relations.

4. **Employee Responsibility:** The employee(s) will:

   a. Make a mental note of what is occurring.

   b. Call ext. 711 (Public Safety).

   c. Assist with evacuation if needed.

   d. Notify immediate supervisor.

5. **Policy and Procedure Overview:** If a civil disturbance or animal security issue occurs on campus.

   a. Public Safety will:

      1) Dispatch officers to the scene.

      2) Call Baltimore City for additional assistance, if necessary.

      3) Establish field command Post and activate emergency response plans, if required.

   b. The officers will:

      1) Respond to the scene and assess the situation.

      2) Call for additional officers, if necessary.

      3) Take action to restore order and make arrests, if required.

      4) Clear and secure the area.

c. The Emergency Operations Center may or may not be activated depending upon the seriousness of the incident.

6. **Campus Resources:** The following campus resources are available to assist:

a. Office of Public Safety

b. Office of Facilities Management

c. Media Relations

d. Veterinary Services

7. **External Resources:** The following external resources are available to assist:

a. Baltimore City Police Department

b. State Police

c. National Guard

I. Traffic

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a major traffic problem.

2. **Primary Responsible Unit:** The primary responsible unit is Public Safety.

3. **Secondary Responsible Units:** The secondary responsible unit is Media Relations.

4. **Employee Responsibility**: The employee that discovers the traffic emergency will call ext.711 (Public Safety).

5. **Policy and Procedure Overview:** If a traffic emergency develops on campus:

    a. Public Safety will:

    1) Dispatch officers to the scene.

    2) Call Baltimore City Police Department.

    3) Call Baltimore City Fire Department for purposes of re-routing ambulances

    4) Establish a field command post, if required.

    b. The Officers will:

    1) Respond to the scene and assess the situation.

    2) Call for additional officers, if necessary

    3) Re-route traffic.

    4) Clear the area.

    c. The Emergency Operations Center may or may not be activated depending upon the seriousness of the situation.

6. **Campus Resources:** The following campus resources are available to assist with the traffic emergency:

    a. Office of Public Safety

    b. Media Relations

7. **External Resources.** The following external resources are available to assist with the traffic emergency:

   a. Baltimore City Police Department

J. Personnel Trapped in an Elevator

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to personnel trapped in an elevator.

2. **Primary Responsible Unit:** The primary responsible unit is the Operations and Maintenance Department of the Facilities Maintenance Division.

3. **Secondary Responsible Units:** The secondary responsible unit is the University Police.

4. **Employee Responsibility:** An employee(s) that discovers a person trapped in an elevator shall call University Police by dialing 711 from any campus phone. The personnel trapped in the elevator shall contact University Police by dialing 711 using the elevator emergency telephone. University Police then will contact Work Control at 6-7570 to report the emergency.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that personnel are trapped in an elevator the following actions will be expected to occur.

    a. Work Control (during normal working hours) will:

        1) Contact the Elevator Supervisor at 6-3324, by radio or beeper and inform him of the emergency situation. Personnel required to correct the emergency condition will be assigned.

        2) Call University Police at 711 to inform them of the emergency, if they have not been notified previously.

        3) Contact the Director of OM by phone or radio informing the Director that an emergency condition exists on campus.

    b. Shift Supervisor (during off-hours coverage) when discovering or informed of personnel trapped in an elevator will:

        1) Contact by telephone or beeper the on-call elevator mechanic and direct him to respond to the emergency condition.

        2) Contact the personnel trapped in the elevator to let them know that assistance is on the way.

        3) Dispatch a maintenance mechanic to the trouble site to assist the on-call elevator mechanic upon his arrival.

4) Contact University Police when trapped personnel have been removed from the elevator.

c. Administratively:

1) In the event of personnel trapped in an elevator an OM representative will obtain the name and extension number(s) of the personnel trapped in the elevator.

2) In the event that the elevator will remain out of service an OM representative will notify the appropriate campus administrator and assess the impact of the loss of elevator service.

6. **Campus Resources:** The following campus resources are available to assist with personnel trapped in an elevator:

a. Office of Operations and Maintenance

b. Office of Public Safety

c. Employee Assistance

7. **External Resources:** The following external resources are available to assist with personnel trapped in an elevator.

a. Baltimore City Fire Department

K. Flooding

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a major flood on campus.

2. **Primary Responsible Unit:** The primary responsible unit is the Department of Operations and Maintenance, Facilities Management Division.

3. **Secondary Responsible Units:** The secondary responsible units are the Office of Facilities Management, General Services unit, and EHS (RISK Management).

4. **Employee Responsibility:** The employee(s) that discover the flooding condition will:

   a. Notify Operations and Maintenance by dialing Work Control at 6-7570 from any campus phone.

   b. When a Work Controller answers, state his/her name, extension, the building he or she is in, the room number or area of the building that he or she is in, and a brief description of the flooding problem.

   c. Remain on-site and attempt to stop the source of the flooding and assist in protecting University property from damage.

5. **Policy and Procedure Overview:** Upon receiving a call reporting a flood:

   a. Work Control (during normal working hours) will:

      1) Contact the appropriate maintenance supervisor and maintenance personnel required to correct the emergency condition.

      2) Notify the Director of OM by phone or radio that an emergency condition exists.

      3) The Work Controller shall notify and direct General Services to respond to the location of the emergency and perform the necessary housekeeping tasks required.

   b. Shift Supervisor (during off hours coverage) will:

      1) Visit the site and attempt to stop the source of the flooding condition.

2) Contact by telephone or beeper the appropriate on-call maintenance supervisor and maintenance personnel and direct them to respond to the emergency condition.

3) Contact the Director of OM by phone or beeper informing the director that an emergency condition exists on campus.

4) Contact by phone or beeper the appropriate General Services personnel and direct them to respond to the emergency condition.

c. Administratively:

1) An OM representative will notify campus Risk Management of the assessed damages at which time claims of damages may be made.

2) An OM representative will walk the site with the appropriate campus administrator to assess damages to departmental equipment and insure proper clean up of the site.

3) An OM representative will develop and initiate all repair work orders which may be required to restore the office, lab, or instructional areas damaged by the flood.

4) Call the Counseling Center to initiate CISD protocol when flood situation is severe.

5) Notify the Office of Parking and Commuter Services.

6. **Campus Resources:** The following campus resources are available to assist with the flooding condition:

a. Office of Operations and Maintenance

b. Office of General Services

c. Office of Public Safety

d. Office of Environmental Health and Safety (Risk Management)

e. Counseling Center.

7. **External Resources:** On-call Contractors

L. Severe Weather: Hurricane/Tornado

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from a tornado or hurricane condition on campus.

2. **Primary Responsible Unit:** The primary responsible units is the Operations and Maintenance Department.

3. **Secondary Responsible Units:** The secondary responsible units are General Services and the Counseling Center.

4. **Employee Responsibility:** The on-site supervisor will make an assessment based on actual weather conditions and/or National Weather Service forecasts that the potential exists for high winds or a hurricane.

   a. The on-site supervisor will contact Work Control at 6-7570 to inform them of impending weather conditions and direct them to implement the Hurricane/Tornado Procedure.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that the potential exists for a tornado or a hurricane, the following actions will be expected to occur:

   a. Work Control (during normal working hours) will contact the structural section of OM to implement the following:

      1) All roof hatches are to be checked and secured.

      2) All buildings are to be checked for open windows securing any that are found.

      3) All roof drains, gutters and scuppers are to be checked and cleaned as required.

      4) All auxiliary sump pumps are to be checked for proper operation

      5) All on-call shift supervisors and on-call personnel are placed on alert.

      6) All trash receptacles, outdoor furniture, and all other items that could be affected will be secured.

   b. The Shift Supervisor (during off hours coverage), when severe weather conditions are observed, will implement the following:

1) Contact by telephone or beeper the appropriate on-call maintenance supervisor and maintenance personnel and direct them as necessary to mitigate any damage to University Property.

2) Contact the Director of OM by phone or beeper informing the director that an emergency condition exists on campus.

2) Administratively:

1) An OM representative will notify campus Risk Management if any Damages resulted due to the severe weather.

2) An OM representative will walk the site with appropriate campus administrators to assess damages to departmental equipment and insure proper clean up of the site.

3) An OM representative will develop and initiate all repair work orders necessary to correct the damage in conjunction with risk Management.

4) Contact the Counseling Center to initiate CISD protocol if indicated.

3) **Campus Resources:** The following campus resources are available to assist with the severe weather condition:

a. Office of Operations and Maintenance

b. Office of Public Safety

c. Office of Environmental Health and Safety (Risk Management)

d. Counseling Center

4) **External Resources:** The following external resources are available to assist with the severe weather condition:

a. On-call contractors

M. Severe Weather: Winter Storm

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from winter storm conditions on campus.

2. **Primary Responsible Unit:** The primary responsible unit is the Operations and Maintenance Department.

3. **Secondary Responsible Units:** The secondary responsible units are General Services and the Counseling Center.

4. **Employee Responsibility:** The on-site supervisor will make an assessment based on actual weather conditions and/or National Weather Service forecasts that the potential exists for substantial amounts of snow and/or ice.

   a. The on-site supervisor will contact Work Control at 6-7570 to inform them that a snow and ice emergency exists.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that a snow and ice emergency exists the following procedure will be followed:

   a. A snow emergency is defined as follows: snow accumulation of one (1) or more inches and/or ice conditions which clearly hinders the safety of pedestrian traffic.

   b. Work Control (during normal working hours) will:

      1) Act as the single point of contact for coordinating all snow removing activities for the campus. Any questions or inquiries should be directed to Work Control at 6-7570.

      2) Contact the OM Assistant Director and the Snow Crew Team Leader to determine the personnel resources need for snow removal duties.

   c. The snow removal and related duties are the primary responsibilities of the snow removal team and when a snow emergency exists, their regular assigned duties will be reassigned or postponed as required.

   d. Shift Supervisor (during off hours coverage) will:

1) Contact the Snow Crew Team Leader to determine the personnel resources
needed for snow removal duties.
2) Act as the single point of contact for coordinating all snow removing activities for the campus.

3) Contact the Director of OM by phone or beeper informing the director that an emergency condition exists on campus.

4) Advise Risk Management of any related property damage or personal injuries from weather conditions.

6. **Campus Resources:** The following campus resources are available to assist with snow removal operations:

a. Department of Operations and Maintenance

b. Facilities Management, General Services

c. Office of Public Safety

5) Risk Management (EHS)

7. **External Resources:** The following external resources are available to assist with the now removal operations:

a. On-call contractors

N. Earthquake

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to and recovery from an earthquake on campus.

2. **Primary Responsible Unit:** The primary responsible unit is the Office of Public Safety.

3. **Secondary Responsible Units:** The secondary responsible units are the Offices of Environmental Health and Safety (EHS), Facilities Management, Media Relations, Shock Trauma, and the Counseling Center.

4. **Employee Responsibility:** The employee(s) will:

   a. Sound the alarm to evacuate the area, if appropriate.

   b. Call **711** and explain the situation.

   c. Assist with the account of personnel.

   d. Evacuate the affected area.

   e. Shut-off non-essential equipment especially equipment connected to utilities (electric and gas).

5. **Policy and Procedures Overview:** If an earthquake occurs on campus:

   a. Public Safety will:

      6) Call Baltimore City Fire Department.

      2) Dispatch officers to scene.

      3) Call Work Control and EHS.

      4) Call Emergency Management Director.

      5) Contact the Counseling Center to initiate the CISD protocol.

b. Officers will:

1) Respond to the scene and assess the situation.

7) Call for additional officers, if necessary.

3) Assist with evacuation if it is safe to do so.

4) Assist Fire Department and control traffic.

5) Form a protective or restrictive cordon around the area of concern.

6) Assist external resources to clear the area.

8) Fire Department will:

1) Take control of the scene.

2) Evacuate casualties.

3) Eliminate fire hazards.

4) Assess damage to property and determine if property can be used in its current condition.

5) Give the "ALL CLEAR" command when the fire or hazard has been neutralized.

9) O&M will:

1) Look for broken utility lines (gas, electric, water & steam).

2) Report problems to the IC and EMD.

3) Shut-off utilities that pose fire/safety risk.

10) The Emergency Operations Center may be activated depending upon
the severity of the incident.

6. **Campus Resources:** The following campus resources are available to assist with an earthquake:

a. Office of Public Safety

b. Office of Facilities Management

c. Environmental Health and Safety

11) Emergency Management Team

7. **External Resources:** The following external resources are available to assist with an earthquake:

   a. Baltimore City Fire Department

   b. Baltimore City Police Department

   c. Surrounding County Fire Departments

   d. State Agencies

   e. Federal Agencies, including the Military

   f. Shock Trauma

   g. UMMS

O. Utility failures: Natural Gas Leak/Supply Failure

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to a building natural gas leak and / or the failure of the gas distribution system to supply natural gas to the campus.

2. **Primary Responsible Unit:** The primary responsible unit is the Facilities Management, Department of Operations and Maintenance.

3. **Secondary Responsible Units:** The secondary responsible unit is the Office of Environmental Health and Safety.

4. **Employee Responsibility:** The employee(s) that discover a natural gas leak should:

   a. Notify Operations and Maintenance by dialing Work Control at 6-7570 from any campus phone.

   b. When a Work Controller answers, state your name, the building you are in and the location of the gas leak.

   c. Remain on-site and make the building administrator aware of the gas leak.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that a natural gas leak exists, the following actions will be expected to occur:

   a. Work Control (during normal working hours) will:

      1) Contact the Assistant Director, Electrical/Mechanical and the Plumbing Shop Supervisor at 6-7929, by radio or beeper and inform them of the emergency situation. Personnel required to correct the emergency condition will be assigned.

   b. Assistant Director, Electrical/Mechanical or Plumbing Shop Supervisor will decide as to the seriousness of the gas leak and whether or not the building will need to be evacuated. Also, they initiate the following action as necessary:

      1) Call University Police at 711 to inform them of the emergency and to call the fire department and EHS if deemed necessary.

2) Contact number for BG&E to report leaks is (410) 685-0123 should assistance be required in securing gas to the building.

3) Contact the Assistant Director, Electrical/Mechanical and request the electricity to the building be secured if it can be done safely (from outside the effected space).

c. Shift Supervisor (during off hours coverage) when discovering or informed of a gas leak will:

1) Contact by telephone or beeper the appropriate on-call maintenance supervisor and maintenance personnel and direct them to respond to the condition.

2) Contact the Director of OM by phone or beeper informing the Director that an emergency condition exists on campus.

3) University Police at 711 to inform them of the emergency and to

call the fire department and EHS if deemed necessary.

d. Administratively:

1) In the event of a loss of gas services to a building, an OM representative will talk to the appropriate campus administrator to assess the impact the loss of gas service will have on building operations.

6. **Campus Resources:** The following campus resources are available to assist with the gas leak/supply failure:

a. Facilities Management, Department of Operations and Maintenance

b. Facilities Management, General Service

c. Office of Public Safety

d. Office of Environmental Health and Safety

7. **External Resources:** The following external resources are available to assist with the gas leak/supply failure:

a. On-call contractors

b. Baltimore Gas and Electric

P. Utility Failures: Electric

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to a building electrical utility failure.

2. **Primary Responsible Unit:** The primary responsible unit is the Facilities Management, Department of Operations and Maintenance.

3. **Secondary Responsible Units:** The secondary responsible unit is the Office of Public Safety.

4. **Employee Responsibility:** The employee(s) that discover an electrical service failure should notify Operations and Maintenance by dialing Work Control at 6-7570 from any campus phone.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that a natural gas leak exists the following actions will be expected to occur:

   a. Work Control (during normal working hours) will:

      1) Contact the Assistant Director, Electrical/Mechanical at 6-7574, by radio or beeper and inform him of the emergency situation. Personnel required to correct the emergency condition would be assigned.

      2) Call University Police at 711 to inform them of the emergency.

      3) The contact number for BG&E trouble desk are (410) 597-7016, 597-7037, 597-7303, 597-7328 should their assistance be required.

      4) Contact the Director of OM by phone or radio informing the Director that an emergency condition exists on campus.

   b. Shift Supervisor (during off hours coverage) when discovering or informed of an electrical service failure will:

      1) Contact by telephone or beeper the on-call high voltage electrician and direct him to respond to the emergency condition.

      2) Contact the Director of OM by phone or beeper informing the Director of an emergency condition exists on campus.

c. Administratively:

1) In the event of a loss of electrical services to a building, an OM representative will talk to the appropriate campus administrator to assess the impact that the loss of electric service will have on building operations.

2) An OM representative will contact Risk Management to coordinate insurance services to handle related property damage or loss.

6. **Campus Resources:** The following campus resources are available to assist with the electrical service failure.

   a. Facilities Management, Department of Operations and Maintenance

   b. Facilities Management, General Services

   c. Office of Public Safety

   d. Office of Environmental Health and Safety

7. **External Resources:** The following external Resources are available to assist with the electrical service failure:

   a. Baltimore Gas and Electric

   b. On-call contractors.

Q. Utility Failures: Water Service

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to a building water service failure.

2. **Primary Responsible Unit:** The primary responsible unit is the Facilities Management, Department of Operations and Maintenance.

3. **Secondary Responsible Units:** The secondary responsible units are the

   Public Safety and EHS.

4. **Employee Responsibility:** The employee(s) that discover a water service failure shall notify Operations and Maintenance by dialing Work Control at 6-7570 from any campus phone.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that a water service failure exists, the following actions will be expected to occur:

   a. Work Control (during normal working hours) will:

      1) Contact the Assistant Director, Electrical/Mechanical at 6-7574 and Plumbing Shop Supervisor at 6-7929, by radio or beeper and inform them of the emergency situation. Personnel required to correct the emergency condition would be assigned.

      2) Call University Police at 711 to inform them of the emergency.

      3) Contact the Director of OM by phone or radio, informing the Director that an emergency condition exists on campus.

   b. Shift Supervisor (during off hours coverage) when discovering or informed of an electrical service failure will:

      1) Contact by telephone or beeper the on-call Plumber and direct him to respond to the emergency condition.

      2) Contact the Director of OM by phone or beeper informing them that an emergency condition exists on campus.

      3) Call University Policy at 711 to inform them of the emergency.

c. Administratively:

1) In the event of a loss of water services to a building an OM representative will talk to the appropriate campus administrator to assess the impact that the loss of water service will have on building operations.

2) OM representative will contact Risk Management to coordinate insurance to handle related property damage or loss.

6. **Campus Resources:** The following campus resources are available to assist with the water service failure.

a. Division of Facilities Management, Department of Operations and Maintenance

b. Office of Public Safety

c. Office of Environmental Health and Safety (Risk Management)

7. **External Resources:** The following external resources are available to assist with the water service failure:

a. On-call contractors

3) Baltimore City Water Department

R. Utility Failures: Steam

1. **Purpose:** The purpose of this procedure is to provide guidance regarding the response to a building steam service failure.

2. **Primary Responsible Unit:** The primary responsible unit is the Division of Facilities Management, Department of Operations and Maintenance.

3. **Secondary Responsible Units:** The secondary responsible units are Public Safety and Environmental Health and Safety.

4. **Employee Responsibility**: The employee(s) that discover a steam service failure shall notify Operations and Maintenance by dialing Work Control at 6-7570 from any campus phone.

5. **Policy and Procedure Overview:** With the receipt of the call to Work Control that a steam service failure exists, the following actions will be expected to occur:

   a. Work Control (during normal working hours) will:

      1) Contact the Assistant Director, Electrical/Mechanical at 6-7574 and Plumbing Supervisor at 6-7929, by radio or beeper and inform them of the emergency situation. Personnel required to correct the emergency condition would be assigned.

      2) Call University Police at 711 to inform them of the emergency.

      3) Contact the Director of OM by phone or radio informing the Director that an emergency condition exists on campus.

   b. Shift Supervisor (during off hours coverage) when discovering or informed of steam service failure will:

      1) Contact by telephone or beeper the on-call Plumber and direct him to respond to the emergency condition.

      2) Contact the Director of OM by phone or beeper informing them that an emergency condition exists on campus.

      3) Call University Police at 711 to inform them of the emergency.

      4) Contact number for Trigen to report service interruptions is 410-547-

8326 should assistance be required in securing steam service to the building.

c. Administratively:

1) In the event of a loss of steam services to a building an OM representative will talk to the appropriate campus administrator to assess the impact the loss of steam service will have on building operations.

6. **Campus Resources:** The following campus resources are available to assist with the water service failure.

   a. Division of Facilities Management, Operations and Maintenance Department.

   b. Office of Public Safety

   c. Environmental Health and Safety

7. **External Resources:** The following external Resources are available to assist with the steam service failure:

   a. Trigen Baltimore Energy Corporation

d. Communication Failure Procedure

1. **Purpose:** The purpose of this procedure is to outline the steps that need to be taken in the event of telephone communication failure; to identify the magnitude of the telephone communication failure; and, to outline how to proceed with notifying the responsible unit(s) of the failure.

2. **Primary Responsible Unit:** The Office of Voice Communication is the primary responsible unit.

3. **Secondary Responsible Unit(s):** The Office of Public Safety and Bell Atlantic are the secondary responsible units.

4. **Responsibilities:** Incidents of telephone communication failure will be categorized by seriousness and level of response required. The procedure to be followed in each type of incident is included with each incident.

   Level I Incidents: An individual employee does not have dial tone on his or her individual line or on multiple lines on the phone set. When this incident occurs, the employee should contact the departmental telephone administrator to report the problem. The departmental telephone administrator should locate a working phone and line and contact the Voice Communication Office at 6-6858 to report the trouble to the telephone operators. The telephone operators will produce a trouble ticket for response by the voice technicians. The departmental telephone administrator will need to know the station number(s) of the problem sets, the KS (Key System) that the lines are in, the lines that are without dial tone, the location of the problem (building and room number), and the administrator phone number and location.

   Level II Incidents: An entire department or building does not have dial tone. When this incident occurs, the employee should contact his or her departmental telephone administrator to report the problem. The departmental telephone administrator should locate a working campus phone and line or use a working pay phone to contact the Voice Communication Office at 6-6858 or dial 410-706-6858 to report the trouble to the telephone operators. If the departmental telephone administrator cannot get through on the numbers listed, he or she should try calling 410-234-0361 in Public Safety. If this is unsuccessful, the administrator should come to the Voice Communication office on the 5th Floor of the Health Sciences and Human Sciences Library HS/HSL to report the problem. If the call to the Voice Communication office is completed, the telephone operators will produce a trouble ticket for the voice technicians. The departmental telephone administrator will need to know the station number(s) of the problem sets, the KS (Key System) that the lines are in, the lines that are without dial tone, the location of the problem (building and room number), and the administrators phone number and location.

Level III Incidents: The entire campus is without telephone service. Departmental telephone administrator should try calling the following number 410-234-0361 in Public Safety. If this is unsuccessful he or she should come to the Voice Communication office on the 5th floor of the HS/HSL to report the problem. If it is impossible to get to the Voice Communication office in the HS/HSL, the departmental telephone administrator should go to the Public Safety office at Pine Street Station to report the problem. If this facility is not available the administrator should locate the Emergency Operation Center established as a result of the disaster and communicate the telephone communication failure.

Appendix A: Communications Checklist

Emergency Management Team (Team) is activated:

1. Emergency Management Director or designee notifies Team members.
   a) via telephone
   b) by E-Mail
   c) other means, as necessary

2. Notify UMMS, VAMC and other involved parties by telephone

Team assesses emergency situation and provides:

A. **Status Reports** to
   1) President or VP for Administration and Finance
      a) President's Office then notifies Deans and VP's
      b) Deans and Vice Presidents are responsible for notifying faculty, staff and students within their respective schools and units

   e. Office of External Affairs, Assistant Vice President for Communications and Publications, for posting to:
      a) Web
   f. Emergency Number

   g. Fire Wardens via
      a) E-Mail
      b) Telephone with autodialer

B. **Action Reports to**
   1) President or Vice President for Administration and Finance for approval
      a) President's Office then notifies Deans and Vice Presidents

   2) Office of External Affairs, Assistant Vice President for Communications and Publications, once approved by President's Office or VPAF, posts to
      a) Web
      b) Emergency number

   h. Fire wardens via
      a) E-Mail
      b) Telephone with autodialer

   i. Media, as necessary, by OEA, AVP for Communications and Publications

Appendix B: Protocol for Critical Incident Stress Debriefing

Under development

ATTACHMENT #2 - Planning for Local Area Defense Demonstration, Vol. 2, Feb. 2003-Apr 2004

Planning for a Local Area Defense Demonstration

Volume 2

April 2003 – February 2004

Meeting Agendas
Minutes & Slides

Meeting Agendas
Minutes & Slides

Goble, Virginia (Ginny)

From: COLIN MACKENZIE, MD [cmack003@umaryland.edu]
Sent: Monday, March 24, 2003 9:04 AM
To: yxiao; Dischinger, Pat; Jon Mark Hirshon, MD, MPH; oglivie; ron.poropatich; Johnson, Cheryl; Goble, Virginia (Ginny); Dickler, Howard; J. Glenn Morris, Jr.; STANDIFORD, HAROLD; Edward Cornwell; Leach, Mary; william.beninati@pentagon.af.mil; Greenberger, Michael; John Krick; David Blythe; Julie Casani; Jeffrey Roche; 'mdonnenb@umaryland.edu'; clyburn; pbeilenson; SPEARMAN, JOHN; Stringer, Jeanne; Levine, Myron; nkossi.dambita; ruth.vogel; Campbell, James; parker; GANOUS, TIM; ralcorta; Steiger, George E LTC SBCCOM; rrothman@jhmi.edu; dburke@jhsph.edu; dtaylor@jhsph.edu; gkelen; jdonohue; Whitby, Linda Dr FBA; Grove, James W. LTC; jflynn; gzimmer1; Anderson, Bruce; jarose; smvarney; rthompso; tshirtman45; SCHRADER, DENNIS; jerry.stockton; pat.redmiles; dfloccare; rbass; Tate, Pat; Morgan, William; pkbuckm; dwhyne; ganderson@cbmse.nrl.navy.mil; Thorne, Craig; Donald Lumpkins; Ballard, Ed; mrippleocme; jmt764; divezul; robert.mercer; Barnes, Cleveland; Burmaster, Carrie; tlockwood; Jaeger, James; Rowan, Robert; Hill, James
Subject: Agenda meeting April 8th at NSC

The following Agenda regarding the Local Area Defense (LAD) Demonstration will be discussed at the National Study Center for Trauma & EMS (701 W. Pratt St , 5th floor-- Parking opposite -- bring ticket for validation).

AGENDA

Introduction and summary of funding Objectives & Timeline
Colin Mackenzie, NSC

Debriefing Summary for Free State Response 2002
Major Shawn Varney, USAF

Chemical " Nerve Gas " Agents -- Detection & Protection
Prof Mohyee Eldefrawi- Pharmacology U of MD , SOM

Data from the response & outcomes of the Tokyo Subway Sarin attack
Colin Mackenzie , NSC

Haddon's Matrix and Homeland Defense
Pat Dischinger -- Epidemiologist NSC

General Discussion and Questions

We look forward to seeing you on April 8th 10 - 12 Noon
Pastries will be served . Question: contact Cheryl Johnson 410 -328-7231

Colin Mackenzie

Local Area Biodefense/Surveillance Meeting Notes
April 8, 2003
10 a.m. – 12 noon
National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

Baltimore City Health Department
Daniel Barnett, MD, MPH for Ruth Vogel (daniel.barnett@baltimorecity.gov)
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Maryland Army National Guard
LTC Jim Grove (james.grove@md.ngb.army.mil)
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John Donohue, Region III EMS Coordinator (jdonohue@miemss.org)

Office of the Chief Medical Examiner
Dawn M. Zulauf (*chiefinvestigator@ocmemd.org*)

Office of the Governor
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Mohyee Eldefrawi, PhD, Professor of Pharmacology (mlde001@umaryland.edu)

UM School of Social Work
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USAMRMC, TATRC
LTC Mary Parker, MD (parker@tatrc.org)
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United States Air Force
Major Shawn Varney, MD, Chief, Homeland Security and Disaster Preparedness (C-STARS) (smvarney@aol.com)

VA Medical Center
Robin Rossiter (robin.rossiter2@med.va.gov)

The meeting started with those present introducing themselves (see page 1 with listing). Dr. Mackenzie welcomed Tom Lockwood, Homeland Security Advisor for Governor Ehrlich and all others present. Mr. Lockwood described how Homeland Defense was a high priority of Governor Ehrlich. The Governor had attended a meeting in Washington, DC on Capitol Hill when the Capitol had to be evacuated and he decided that being better prepared was a high priority for Maryland. Some of the senior members of Governor Ehrlich's staff were in the Pentagon when it was hit on September 11th and members of his staff have dealt with the events of September 11 including constituent services and bereavement. At the state level, we have world class assets, including many assets such as the group here that have not yet been integrated into state planning. Academic, business, not for profit community can go for a strategy that will leverage and integrate these strengths. We have other programs like Biowatch and other efforts that have not yet been integrated. Part of this discussion at the state level has to be a discussion of protocols, data and information fusion, and integration into operations at the front line. So this is a very important effort that has the attention of the Governor who appreciates everyone's efforts to make this become a success.

Dr. Mackenzie then expressed thanks to everyone for their contribution to the earlier meetings. These meetings were the reason that we were able to secure the funding from TATRC at Ft. Detrick. In return, we hope to be able to benefit the groups who have participated. Next, Dr. Mackenzie introduced Dr. .Shawn Varney, USAF, and asked him to describe the debriefing of the Freestate 2002 Exercise.

Dr. Varney: Freestate 2002, a hospital based exercise, July 2002. Major Varney described his role as an ED physician and his preparation of USAF personnel coming through Shock Trauma for worldwide deployments and his role in Homeland Security for USAF. Most exercises are EMS driven, but this one was hospital based.

Because a full blown exercise was too much to "bite off," we simulated the pre-hospital portion and then started at the hospital door to make it an "internal test." The question was how well can UMMS including Shock Trauma work together to handle 200 mass casualty victims. I am going to describe the background that lead up to the exercise and lessons learned and recommendations that we can implement to avoid future mistakes.

Before September 11, USAF was implementing a trauma program to work alongside Shock Trauma personnel in an organization called C-STARS, Coalition for the Sustainment of Trauma and Readiness Skills (See Attachment #1, Dr. Varney's slides, abbreviated because of huge file size). USAF had areas of expertise to share, e.g., decontamination, WMD, field capabilities. Hospital and military experts (Gen. Carlton, USAF) visited Israel to see their preparations for chemical attack (see slides) including warehouses for stretchers, high school students serve as patient movers/escorts, supplies for response to WMD are stored in ready state, outside wall of hospital has multiple shower heads with decontamination facilities for 100s of patients with soap and water. On the inside, the ambulance bay is lined with shower heads/hoses. UMMS decided to improve facilities and training for WMD – so they proposed Freestate 2002 exercise. Objectives (see slides) were similar to the Biodrill Exercise Freestate 2003. Command and control was set up inside the hospital and to train as many USAF/civilians as possible including city/state/federal/national to strengthen relationships and know who to call in emergencies. Plan must be simple and as close to everyday practice as possible with a few variations. We want to be able to operate a mass casualty event and still carry on the essential emergency functions of the hospital. Other agencies involved included

MIEMSS, National Guard, MEMA, Baltimore City and JAHCO. Scenario was phosgene gas at stadium in which multiple people began to get sick and then a second event was a bomb explosion in a motor home in the stadium parking lot resulting in conventional injuries leading to 200 "patients" sent to Shock Trauma. Everyone in UMMS was involved, telephone operators, patient registration, administration, fire department, etc. Lessons learned: communicating with patients – over 100 radios were not enough – need more. Communication with control center was a big problem. Computer systems/ cell phones, etc. not dependable. Major problem was poor information flow; if one cannot get information into the command center, one certainly cannot get it out. Information about how many patients were coming in was not conveyed. Cell phones have dead spots in the hospital; message boards/numbers are alternatives.

Patient transport was a big issue even though it was simulated. The number of gurneys/wheelchairs needed was grossly underestimated. Safely moving people was a big factor. Space is a major issue in any hospital (for storing things). Color coded directions of floor were useful. Pre-positioned supplies would be helpful, e.g., gas masks. It was chaotic waiting for people to come in. We recommend that a simple checklist should be developed with the 10 basic things you should do in an emergency, contact #s, etc. We moulaged 200 patients to make this realistic. One of the problems, even though it was not excessively hot, was dehydration among the decontamination tent personnel who were dressed in protective gear. If it were 100% humidity – what would your work/rest cycles be like? Dr. Varney showed some photos here of the Exercise. Operations Center: It was not so much a problem of fax machines and equipment – rather, people just did not know where it was. What would help would be equipment that could be moved on a cart to wherever was available, should the Operations Center become not available – mobile phones, etc. that could be connected to fixed telephone lines. Initially keep it simple, and as the complexity of the incident goes up, so will the preparations for necessary communications.

Questions?

Q: How does the command and control/ incident command function? (exact wording difficult to hear on tape)

A: This was a point of discussion at the Freestate 2003 table top exercise last Thursday – We spent about 30 minutes on the Hospital Emergency Incident Command System (HEICS). How to improve information and ensure organization from above, because if we do not have that, everything falls apart. We need direct lines of communication between the command center and the wards, ICUs, TRU, ER, OR, etc. Again, communication of accurate information allows you to understand the problem and plan accordingly.

Q: The coordinator information?

A: She needed a lot of information and received a lot, but it was very difficult to organize it quickly. So, if we could have a system for collecting incoming information and organizing it rapidly and then distributing it – that is what we need. You must know what resources you have available and be able to coordinate with them whether internal or external agencies. Patient tracking was also difficult – some sort of computerized hand held device is needed, although this may be compromised in a mass attack – but one needs some way to let people know what is happening to patients and their disposition.

Digital cameras would also help. In that way, you can take a picture of every patient that comes in and post it on the web – so that people can identify family members so they can know which hospital to go to. The media – your best friend or worst enemy. You need to have strong ties with them up front. Hospital media can be helpful. We had excellent support from the media. Another thing to do is to prepare scripts for the media, e.g., what happens if you were attacked with mustard gas or sarin – provide basic facts. Mental Health: We found this was a huge success – coping with the over triage. There were about 15 people dealing with the 45 "walking worried" and it was not enough. For resuscitation, one should take advantage of other resources, the military, National Guard. We had the Air National Guard come in, helping out with evacuation – simulating transfer of patients to other hospitals. Other assets included, fire department, police, MEMA, establish MOU's beforehand, get government agencies involved. There was a lot learned from the debriefing about things we can do better.

Q: Cost?

A: The Air Force contributed $160,000. This did not cover salaries, overtime – just covered supplies – we stayed within budget. The only salary it covered was that of the dedicated civilian exercise planner.

Q: Is decontamination same whether chemical or biological or blister agent?

A: The basic approach to decontamination is – get rid of the clothing and you get rid of 90% of the contamination whether it's radiological, chemical, blister, but not so much with biological because of inhalational mode of transmission.

Comment: The chemical agents are inhaled too.

A: Inhaled chemical agent is going to overwhelm victim rapidly. Simply decontaminate the patient and treat with the antidote, and support the vital functions.

Dr. Mackenzie made reference to the binder of minutes of the previous four monthly meetings for the LAD Demonstration planning, October 2002-Janury 2003. The binder also contains a copy of the Campus Emergency Plan and some published articles on Sarin release in Tokyo, hospital planning, Informatics for Disasters and Preparing Non-clinical Hospital Workers for Terrorism.

Dr. Mohyee Eldefrawi, Professor of Pharmacology, University of Maryland, spoke next. Since the late 50's, I have been thinking about and conducting research on nerve agents and related topics. In the late 60's, Dr. Eldefrawi described how he, himself, nearly had a laboratory accident. Symptoms that are felt when one thinks you may have been exposed are actually quite different from symptoms of nerve agent, e.g., soman exposure. So psychological casualties can feel very real symptoms even though they only think they have been exposed. Dr. Eldefrawi has published more than 100 academic papers on nerve agents. Because of the variety of backgrounds in the audience, Dr. Eldefrawi summarized information of these nerve agents for us (see slides, Attachment #2). Sarin (GB) is a close cousin of soman – phosphoric esters. These agents have similarities to agricultural chemicals/insecticides – phosphate esters, not phosphoric. Nerve agents are not gases – these are liquid with sufficient volatility to evaporate and cause people in the vicinity to get sick. When deployed, they will be aerosolized and highly toxic – inhalation pathway most relevant – high lipid chemicals get from the environment into

the circulation through the lungs within seconds and go to the brain – spinal cord, endplate. Major toxicities to nervous system – cholinergic crisis. Neuropathy may occur – but this is a late effect – not seen for 2-3 weeks due to demyelination of motor nerves – falling leading to paralysis. The first responders will see the cholinergic crisis. Acetylcholine (Ach) is an enzyme crucial to nerve function throughout the body. A neurotransmitter, synthesized and released by nerves, skeletal and smooth muscle (heart and gut) and glands. Ach communicates with nervous tissue to produce a response. Enzyme Acetylcholinesterase (Achase) removes Ach within a milli second. If Achase is inhibited, then Acti will persist and produce cholinergic effects. What does this response mean – in the heart, smooth of gut of eye – everywhere it causes an over stimulation of all places that normally respond to Ach. If Achase is inhibited by a nerve agent, it takes 17 hours not one millisecond for Ach effects to be reversed.

The other side of the cholinergic crisis is at the skeletal muscle and plate, diaphragm and respiratory muscle. Fasciculation and muscle tremors start responding repetitively until within minutes, there is total paralysis leading to asphyxia – the fatal lesion from these agents. Those at ground zero, where these agents are released, do not even give the first responder time to get there – they are so rapidly fatal. Symptoms that identify nerve agent poisoning: acute response are most identifiable – peripheral neuropathy is a late effect. Detection: sensors – portable devices used by the Army to identify not just a nerve agent, but the actual agent. Mass spectrometer can tell you in an air sample from the site what the agent is within minutes. It actually makes little difference from the point of view of treatment and management which of the agents, Sarin, Soman Vx, etc., it is – the treatment is the same for all these agents. To wait until the sample is definitively analyzed can take 20 min – you can detect agent by knowing the symptoms of cholinergic crisis. The victim is the best detector in the field. Soman shows up with pin-point pupils – look into the eye, salivating, lacrimating, severe abdominal pain, incontinence bowel and bladder, involuntary muscle twitching, massive outpouring of muscarinic and nicotinic effects of autonomic nervous system.

Mobile sensors can detect the poisoning agent within minutes. Treatment has been around for years – agricultural workers with insecticides should always carry around atropine 2mg dose (IM or IV). Cholinergic crisis is mainly a muscarinic response – atropine is a blocker of muscarinic effects – it antagonizes them.

Cholinesterase measurement in blood is a biomarker of exposure to nerve agents – assay is very quick – severity of exposure can be determined. Atropine will prevent attack, delay the expression of autonomic nervous system and allow the patient time to recover. Agents that will reactivate the irreversibly inhibited enzyme (pralidoxime) – it does not work 100% because of "aging" – this means the enzyme cannot be reactivated with pralidoxime. The victim needs to be supported with a ventilator to allow the system to recover by producing new Achase, having eliminated enough of the nerve agent for recovery. Atropine and Pralidoxime becomes the treatment of nerve agent poisoning – deployed as self-injector kits. There are other modalities, but pralidoxime/Atropine is most successful. A carbamate and atropine are used in a prophylactic manner when exposure anticipated. Atropine 2 mg dose is usual treatment – repeat only if needed as it is toxic – pralidoxime one dose.

We know that the nerve agents are, what they are capable of, we know they are neurotoxic. Dr. Eldefrawi then summarized the key points.

Q: Atropine duration of effect may be less than organophosphorus – how often do you repeat atropine?

A: If patient exposed, atropine given, then it should stay in the system longer than the nerve agent, these are phosphoric acid moieties that dephosphorylate fairly fast so that the addition of a carbonate or pralidoxime can sometimes be successful – atropine should be repeated according to how well the symptoms are responding -

Q: Is the effect of these agents likely to be greater in smokers?

A: Certainly; One of the major effects is on the respiratory muscles – the bronchial muscles are sensitive to persistent Ach – difficulty breathing – also secretions.

Q: Does humidity affect the hydrolysis of these agents? (Question difficult to hear).
A: High humidity with heat makes these agents less active – humidity will help them hydrolyse and break down (tape change here).

Tape incorrectly inserted (apologies). Dr. Mackenzie and Dr. Dischinger's presentations summarized from memory and slides.

Dr. .Mackenzie started by identifying his experience of 33 years as an anesthesiologist using anticholinesterases (that also produce cholinergic effects like the nerve agents) – to reverse muscle paralysis induced to facilitate surgery. He then went on to describe data in the Sarin attack of March 20, 1995 in Tokyo. (see slides, attachment #3). Sarin was delivered into five subway cars in a dilute form in plastic bags during rush hour. The subway cars delivered it to 15 subway stations creating a lot of confusion for the EMS who thought these were all separate events. 5,500 civilians were affected and there were 12 deaths. The timeline of events shows that at 7:55 a.m., five bags in different subway cars were punctured with sharpened umbrella tips. Fourteen minutes later, the first call to the Tokyo ambulance center was made. The nearest hospital, St. Lukes, to the majority of subway stations received their first call indicating a problem 21 minutes after Sarin release. They were incorrectly told by the Tokyo fire department that a gas explosion had occurred in the subway. St. Lukes started preparing to receive carbon monoxide and burn victims. At 8:25 a.m. – 30 minutes after Sarin release, the first of 500 patients to arrive within the first hour, walked into the hospital with difficulty seeing, eye pain, choking. Initial victims told St. Lukes – no explosion, rather people were collapsing all around them. At 8:40 a.m., first ambulance and 8:43 first cardiac arrest patient. With 500 people in the ED within an hour, they still had no diagnosis.

At 9:20 (1 hour and 25 minutes after Sarin release), they cancelled clinics and routine surgery at St. Lukes and at 10:30 a.m., a physician from the Self-Defense Force suspected Sarin as the agent because he had seen two other episodes where the same terrorists in 1992 and 1993 had released Sarin. It was not until 11 a.m. – more than thee hours after the release, that the agent was confirmed by National Institute Standards & Technology in the U.S. confirming gas chromatographic analysis of Sarin. The victims got to St. Luke by foot 1/3, by taxi ¼, by car ¼, and ambulance 7%. There was evidence of secondary exposure to Sarin among 10% of first responders and one-quarter of the hospital staff. The first responders were exposed due to Sarin on victims clothing, especially when they were transported in closed poorly ventilated vehicles, such as ambulances. Hospital staff apparently had inadequate protective clothing – they did not have a diagnosis for so long that many suffered secondary Sarin exposure. Forty percent

of nursing assistants, 25% nurse volunteers and 22% doctors have evidence of Sarin exposure.

This single terrorist attack required a significant resource response from rescue services. More than 80% of 1,650 EMTs in Tokyo were called upon. 131 ambulances were sent to 15 subways and it was considered by the Japanese to be the largest disaster since WW II. Triage staff were sent to the field sites, including 47 physicians, 23 nurses, 3 clerks. Hospital staff at St. Lukes included 740 people (165 physicians, 477 nurses, 68 clerks, 30 volunteers). The symptoms of the victims were as described by Dr. Eldefrawi – muscarinic and nicotinic effects of cholinergic crisis – eye pain, lacrimation, pin-point pupils, headache, throat pain, difficulty breathing, nausea, dizziness, etc. The debriefing after the disaster identified several breakdowns, similar to those described by Dr. Varney at the Free State 2002 exercise – namely – structural problems – not enough decontamination facilities – no public resource. Planning for such a disaster and management were not adequate. Communication was a big problem – especially two-way transmission problems. The last problem was the lack of timely diagnosis. (three papers for Academic Medicine are included in the Volume I binder for LAD Demonstration – this presentation was abstracted from these and other original sources).

Dr. Mackenzie addressed questions then invited Dr. Dischinger to discuss Disaster and Mass Casualty Incidents by using Haddon's Matrix (see slides, Attachment #4).

Dr. Dischinger presented an approach to identifying risk factors and preventive strategies to events such as a terrorist attack. The Haddon Matrix was developed by William Haddon, an epidemiologist and we at the National Study Center used it to apply to vehicle crash investigators. On the Y axis, we have the phase (pre-event, event, post-event) and on the X axis, factors such as host, vector environment (physical) and socioeconomic. Dr. Dischinger then went on to describe that in the pre-event phase, everything that determines whether an event will take place should be considered. During the event, everything that determined if an injury results is considered and in the post-event phase, factors that determine whether an injury results are included in the matrix. Dr. Dischinger then described how this would apply to a motor vehicle crash, e.g., pre-crash factors included the quality of the driver's eyesight, whether the driver was intoxicated, experienced, how much they had travelled, etc. vector (of the vehicle) were the state of repairs of brakes, wear of tires, center of gravity (of overloaded vehicles) speed, etc. and physical environment include road curvature and surface coefficient of friction (rain/ice, etc.). Socioeconomic factors described included attitudes about alcohol, laws related to impaired driving/speed limits. Dr. Dischinger then went on to describe an event (crash) matrix and post crash matrix (see slides).

To put the matrix into perspective, the purpose for the LAD Demonstration planning was to use Haddon's Matrix as a tool to help the planning process – to identify the risk factors, so that these could be mitigated; to look at preventive strategies that could be used for planning the responses to terrorist attack. We wish LAD planners to complete this matrix for their area of expertise (see e-mails sent by Dr. Mackenzie, April 9th). Dr. Dischinger then presented a completed matrix for the Titanic Disaster where pre-event host factors were the captive population aboard, the ship worthiness (vector) weather conditions/visibility (physical environment) and lack of awareness of safety issue as an vessel "unsinkable" (socioeconomic). The host factors at the sinking event were unavailability of life jackets, vector was an iceberg, physical environment,debris, flooding, gravity and socioeconomic factors were panic, chaos, disbelief. Post event

factors included gender and age (women and children saved first) vehicle (drowning) physical environment (life boat availability), and socioeconomic factors, grief, missing persons.

Dr. Dischinger then presented a matrix for a disaster event that is described in the attached slides that are broken down with pre-disaster, disaster incident, post-disaster/mass casualty incident. Dr. Dischinger described a generic matrix that we ask you to complete by April 21st.

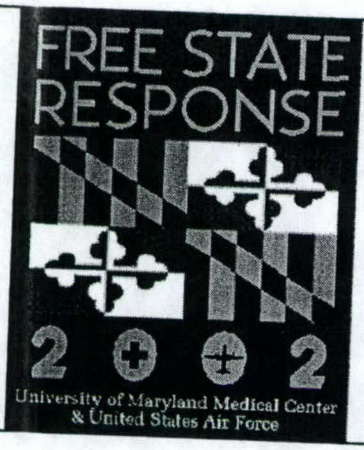
Comments were then provided (regrettably, the full text not available as no tape record) by LTC Grove on the National Guard role, by LTC Rose on SBCCOM. In response to a question about communications used by the military as opposed to civilian sources, Captain Marcus Johnson, a communications specialist, described several systems including satellite phones, and communications linked with GPS (regrettably, the full text of the response is unavailable). Dr. Jaeger, Director, Environmental Health & Safety at UMB, responded with information about EHS role and resources. Lt. Cleveland Barnes described the function of the UM Public Safety. Tom Lockwood, Governor Ehrlich's Office, identified that there were many other efforts on-going that the state knows about and how these should be used to capitalize on the biotechnology expertise by the state. Mr. Lockwood will address the LAD Demonstration planning meeting next month. We will also have a presentation that will aggregate the data on the completed Haddon's matrixes received from LAD planning participants. There was a discussion about protective gear.

Q: Dr. Mackenzie: How much protective equipment is available in the ED?

A: Dr. Hirshon: I can't say in the UM, ED – usually there would be enough protective clothing to process patients.

A: Dr. Varney. I know University bought 10 for the exercise and Air Force bought 12 = 22 – this together with separate air powered respirators, gloves, boots, etc. One has to set up some decontamination facility and deal with psychological casualties.

Please complete the Haddon Matrix by April 21st
May 13 (10 a.m. – 12 noon – next meeting).



FREESTATE RESPONSE 2002

Hospital-Based Disaster Training Exercise

Baltimore, Maryland, 13 July 2002

A University of Maryland-Air Force Medical Service Coalition Disaster Preparedness Initiative

C-STARS
Coalition for Sustainment of Trauma And Readiness Skills

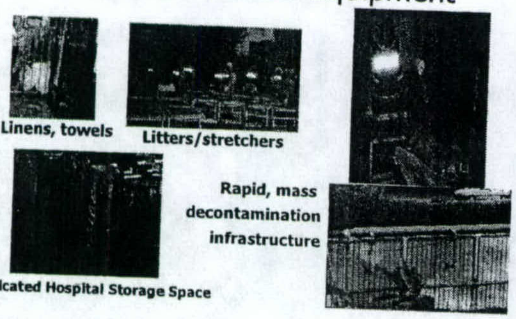
FREESTATE RESPONSE 2002

- Background
- Objectives
- Exercise Details
- Lessons Learned

Exercise Background & Rationale

- Sep 2001 University of Maryland contract with US Air Force
  - Training of AF personnel at the Shock Trauma Center
    - C-STARS=Coalition for the Sustainment of Trauma and Readiness Skills
  - UM-AF training in disaster preparedness
- UMMC / STC / AF relationship generated invitation to observe Israeli exercise in Dec 2001

Decontamination Equipment



Dedicated Hospital Decon

Exercise Objectives

- To exercise command and control inside the medical center during a MCI
- To train UMMC and AF medical staff to respond to MCIs (including WMD)
- To build and exercise city, state, and national relationships for disaster response

Exercise Objectives (cont)

- To test the assumptions of the UMMC emergency management plan
- To identify gaps in services and resources to meet the demands of a MCI
- To evaluate the ability of all UMMC/STC components to mobilize in a coordinated manner and to recover operations in the midst of a MCI

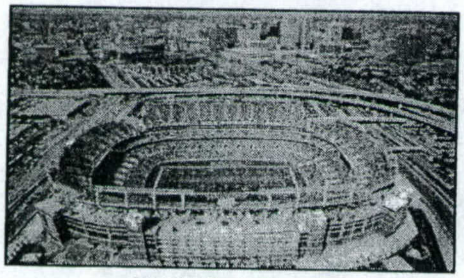
Exercise Participants

- City
  - Baltimore City Fire Department
  - Baltimore City Health Department
  - Baltimore City Police Department
  - R Adams Cowley Shock Trauma Center
  - University of Maryland, Baltimore
  - University of Maryland Medical Center
  - University of Maryland School of Medicine
  - Veterans Affairs Maryland Health Care System

Exercise Participants

- State
  - Maryland Department of Transportation
  - Maryland Emergency Management Agency
  - Maryland Institute for Emergency Medical Services Systems
  - Maryland National Guard (Army and Air)
  - Maryland Stadium Authority
- National
  - Joint Commission on Accreditation of Healthcare Organizations
  - United States Air Force Medical Service

Disaster Exercise Scenario: Baltimore Ravens' Stadium Terrorist Attack



70,000 Seat Capacity

Exercise Scenario and Timeline

1. Raven's Stadium on day of football game
2. Terrorists release chemical agent in gas form
3. Fans begin to experience irritation of skin, eyes and throat with coughing, choking, feeling of tightness in the chest
4. Large explosion from terrorists' motor home occurs on another stadium parking lot causing many more injuries
5. Police, fire, EMS & HAZMAT Teams respond (simulated)

Exercise Scenario and Timeline

6. Ambulatory patients rapidly overwhelm UMMC Emergency Department and all other Emergency Departments in Baltimore
7. Exposed patients are decontaminated and triaged outside hospital before entering for treatment
8. UMMC/STC provide patient care for 200 casualties
9. Air Force assets provide assistance with decontamination, clinical augmentation, and aeromedical evacuation

UMMC Functional Training Areas

- Administration
- Command and Control
- Communication
- Central Sterile Supply
- Critical Care (and Respiratory Therapy)
- Decontamination
- Emergency Medical Care (ED, TRU, VA)
- Field Surgery/Critical Care Augmentation
- Infection Control
- Information Management and Systems
- Laboratory
- Logistics/Medical Supply
- Media/Public Affairs
- Medical Ward
- Mental Health
- Mortuary
- Operating Room/Surgery and Anesthesia
- Pediatrics
- Patient Evacuation
- Patient Transportation
- Pharmacy
- Public Health and Preventive Medicine
- Rehabilitation
- Safety
- Security

Lessons Learned

Communications

- #1 Problem
  - No direct lines of communications between patient care/treatment areas and command center
  - 100 radios used—not enough
  - Phones busy, fax machines failed
  - Cell phones nonfunctional
  - Poor information flow
  - Lack of communication between work areas
  - TRU/ED had no warning of patient arrivals

Communications Recommendations

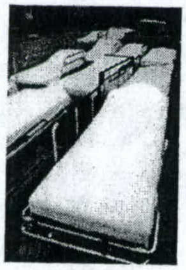
- Back up plans for intra- and inter-hospital communications
  - Internet, intranet, paging system, interoperable radios, runners
  - Have local pre-established message boards
  - Practice internal and external exercises
  - Identify reliable source of info (HEICS)

Patient Transport

- Underestimated need for adequate transport equipment and personnel
- Safety

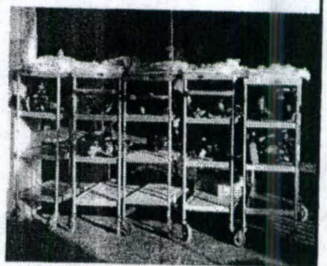
Patient Transport Recommendations

- Storeroom of gurneys, wheelchairs, carts
- Color code directional arrows to ED, TRU, wards, hospital command center, mental health area, cafeteria...



Pre-positioned Supplies

- Needed pre-positioned, mobile carts housing personal protective equipment for decontamination and other supplies



Adequate Planning

- Despite awareness of the upcoming exercise and numerous training sessions, some people still were unclear on their roles

Adequate Planning Recommendations

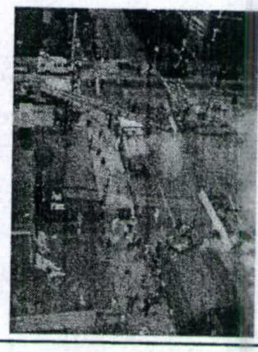
- Regular (at least twice yearly) training exercises to familiarize healthcare providers with their roles
- Checklists
- Encourage review of UMMC emergency management plan in staff meetings
- Offer training to departments

Patient Safety

- University police had to close a busy intersection where patients crossed
- Dehydration among decontamination team

Safety Recommendations

- Always plan for the worst
- Practice



Hospital Emergency Operations Center

- Equipment not permanent
- Not well-known location
- Lack of information flow
- Difficulty with communications

Emergency Operations Center Recommendations

- Maintain a well-known permanent location with sufficient equipment
- Establish direct links to patient care areas
- Radios and television availability
- 2-way radio back-up system
- Direct comm links to bed coordinator, triage officer, decon team

Emergency Operations Center Recommendations

- Team approach
- Establish a uniform chain of command
- "All hazards" approach
  - Simple, general response applicable to many disasters
- Scale the response
  - Complexity increases w/ number of patients

Nursing Coordinator

- Massive amount of information inflow and requirements
  - No organized system to manage it
- Central place to post information
- Known mechanism of info distribution
- Operations center and Bed Manager on different floors
- Didn't use Express Care's communications or patient transport capabilities

Nursing Coordinator

- Create potential documentation now
- Train with it now
- Be aware of resources

Patient Tracking

- Difficult to know who entered UMMC system
- Record of patient destination, treatment, disposition
- Information not communicated to central location

Patient Tracking Recommendations

- Digital camera to post photos of patients on internet or intranet for identification, location purposes
- Handheld computerized patient registration, or at least frequent downloads to central source

Media

- Your best friend or worst enemy
- Never know who is listening

Media

- Organize media area with regular updates
- No cameras inside medical facility
- Prepare scripts for your hospital media

Mental Health

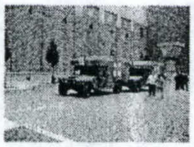
- Played huge role
  - "Worried well"--large # patients
- Need direct communication link with operations center
- Preprinted discharge instructions

Military Critical Care Augmentation

Military Critical Care Augmentation

- Take advantage of relationship with C-STARS
- Direct link communication essential
- Stabilizing capability, not holding

Army and Air National Guard Assets

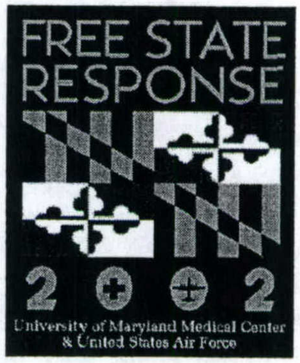



City and Federal Assets



City and Federal Assets

- Establish MOUs before the disaster strikes
- Train with various city, state, and federal agencies via exercises (table top, limited, full-scale)
  - Familiarize yourself with stumbling blocks
- Meet key people in corresponding agencies now
  - Place a face with a name



University of Maryland/Air Force Medical Service
FREE STATE Response 2002
13 July 2002

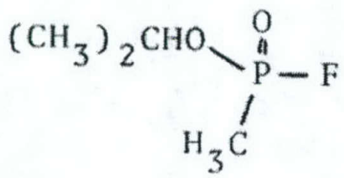
A University of Maryland-Air Force Medical Service Coalition Disaster Preparedness Initiative

UNIVERSITY OF MARYLAND MEDICINE

R ADAMS COWLEY SHOCK TRAUMA CENTER
UNIVERSITY OF MARYLAND MEDICINE

Mohyee Eldefrawi, PhD
Professor of Pharmacology
UM School of Pharmacy

ORGANOPHOSPHORUS NERVE AGENTS



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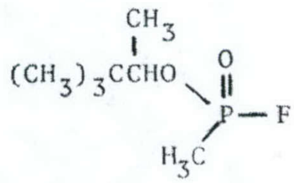

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NEUROTOXICITY

I. ACUTE RESPONSE: **CHOLINERGIC CRISIS**

II. DELAYED RESPONSE: **DELAYED NEUROPATHY**

DETECTION

1. DETECTORS USING DIFFERENT MODALITIES ARE AVAILABLE

2. ACUTE POISONONG SYMPTOMS ELIMINATES THE NEED FOR DETECTORS OR SENSORS

TREATMENT

1. ATROPINE (2 MG IM, IV, REPEAT IF NEEDED)

2. 2-PAM (1 G) + ATROPINE IN SEVERE CASES

Colin F. Mackenzie, MD
Professor and Director
National Study Center for Trauma & EMS

1995 Sarin Attack – Tokyo Subway

- Plastic bags dilute Sarin
- Five subway cars distributed Sarin to 15 subway stations
- 5,500 civilians affected
- Twelve deaths

1995 Sarin Attack – Tokyo Subway

Timeline: March 20, 1995

7:55 am	Five plastic bags punctured with sharpened umbrella tips
8:09 am	First call to Tokyo Metropolitan Ambulance Center
8:16 am	First call to St. Luke's from Tokyo Fire Department identified "gas explosions"
	Hospital began preparations for burn and carbon monoxide poisonings
8:25 am	First patient (on foot) of 500 patients to arrive that hour (three in cardiac arrest)
	Patient c/o eye pain and visual disturbance
	Initial victims identified no explosion, many report collapsing in subway

1995 Sarin Attack – Tokyo Subway

Timeline: March 20, 1995

8:40 am	First ambulance arrived
8:43 am	First cardiac arrest patient arrived by private vehicle
	Still no diagnosis and almost 500 victims in ED
9:20 am	All routine surgery and outpatient clinics cancelled
10:30 am	Press conference. Physician from Self Defense Force suspects Sarin
11:00 am	National Institutes of Standards and Technology (USA) confirms gas chromatograph analysis of Sarin

How did victims get to a hospital in the first hour?

■ On foot	174 (35%)
■ Taxi	120 (24%)
■ Car (public)	67 (13.5%)
■ Car (fire department)	64 (12.9%)
■ Ambulance	35 (7%)
■ Police patrol car	7 (1.4%)
■ Others	31
■ Total	498

Secondary Exposure to Sarin

■ EMT's 135/1,364	(9.9%)
■ Hospital Staff 110/472	(24%)
■ Nurse Assistants	39.3% (11/28)
■ Nurses	26.5% (45/170)
■ Volunteers	25.5% (14/155)
■ Doctors	21.8% (12/55)
■ Clerks	18.2% (12/66)

Resources for 1995 Sarin Attack

EMT's
1,364 EMT's (of total 1,650 in 182 Emergency Teams)

AMBULANCES
131 Ambulances sent to 15 subways
(Largest disaster since World War II)

TRIAGE STAFF ON SITE

Site triage	47 Doctors 23 Nurses 3 Clerks

HOSPITAL STAFF

Hospital (St. Luke's)	36 Resident MD's 129 Staff MD's 477 Nurses 68 Clerks 30 Volunteers 740 People

Victim Symptoms

▪ Eye pain, tearing, constricted pupils	14%
▪ Headache	11%
▪ Throat pain	8.3%
▪ Difficulty breathing ("tightness," "wheezing"	5.3%
▪ Nausea	3.0%
▪ Dizziness	2.5%
▪ Nose pain	1.9%

Problems Identified

Structural – No public decontamination facilities
Software – Disaster planning and management
Communication – Two-way transmission problems
Lack of timely diagnosis (took three hours)

Reference: The Tokyo Subway Sarin Attack
Part 1: Community Emergency Response
Part 2: Hospital Response
Part 3: National and International Responses
Academic Emergency Med 1998; 5: 613-628

Disasters and Mass Casualty Incidents

… as viewed through the Haddon Matrix

Haddon Matrix

Phase	1. Host (human)	2. Vector (agent)	3. Physical environment	4. Socio-economic environment
Pre-Event				
Event				
Post-Event				

William Haddon, Jr, M.D.
Epidemiologist
1926-1985

Motor Vehicle Crash

… as viewed through the
Haddon Matrix

Motor Vehicle Crash

Phase	1. Host (human)	2. Vector (vehicle)	3. Physical environment	4. Socio-economic environment
Pre-Crash, MVC'				
Crash or MVC'				
Post-Crash, MVC'				

Pre-Event Phase:
Everything that determines whether an event will take place

Event Phase:
Everything that determines whether an injury results from the event

Post-Event Phase:
Whether an injury results from the event

PRE Crash

Phase	1. Host (human)	2. Vector (vehicle)	3. Physical environment	4. Socio-economic
Pre-Crash, MVC	Driver vision Alcohol Intoxication Experience & judgment Amount of t ravel	Brakes, tires Center of gravity Jack-knife tendency Speed of travel Ease of control Load characteristics	Visibility of hazards Road curvature & gradient Surface coefficient of friction Divided hwys, one-way streets Intersections, access control Signalization	Attitudes about alcohol Laws related to impaired driving Speed limits Support for injury prevention efforts
Crash or MVC	[redacted]			
Post-Crash, MVC	[redacted]			

Meter Vehicle Crash

Phase	1. Host (human)	2. Vector (vehicle)	3. Physical environment	4. Socio-economic environment
Pre-Crash, MVC	[redacted]			
Crash Or MVC	Safety belt use Osteoporosis	Speed capability Vehicle size Automatic restraints Placement, hardness, & sharpness of contact surfaces Load containment	Recovery areas Guard rails Characteristics of fixed objects Median barriers Roadside embankments Speed limits	Attitudes about safety belt use Laws about safety belt use Enforcement of child safety seat laws Motorcycle helmet use laws
Post-Crash, MVC	[redacted]			

Post Crash

Phase	1. Host (human)	2. Vector (vehicle)	3. Physical environment	4. Socio-economic environment
Pre-Crash, MVC	[redacted]			
Crash or MVC	[redacted]			
Post-Crash, MVC	Age Physical condition	Fuel system integrity	Emergency communication systems Distance to and quality of emergency medical services (EMS) Rehabilitation programs	Support for trauma care systems Training of EMS personnel

The Titanic

Phase	1. Host (human)	2. Vector (vehicle)	3. Physical environment	4. Socio-economic environment
Pre-Event	[redacted]	[redacted]	[redacted]	[redacted]
Event	[redacted]	[redacted]	[redacted]	[redacted]
Post-Event	[redacted]	[redacted]	[redacted]	[redacted]

PRE Disaster or Mass Casualty Incident

Phase	1. Host (human)	2. Vector (biological, chemical agents radiation)	3. Physical environment	4. Socio-economic environment
Pre-Disaster, MCI	Vulnerable populations (in-patients; pregnant; very young/old; immunocompromised; mobility limited) EMS providers vaccination status Education / awareness ("duct tape")	Vaccines	Geographic features Sensors Intelligence Videos	Known terrorist intentions Support for antiterrorism efforts Disaster Drills (per pre-planned protocols)
Disaster or MCI	[redacted]			
Post-Disaster, MCI				

Disaster or Mass Casualty Incident

Phase	1. Host (human)	2. Vector (biological, chemical agents radiation)	3. Physical environment	4. Socio-economic environment
Pre-Disaster, MCI	[redacted]			
Disaster or MCI	Gas masks "Safe rooms" Shelter from debris "Shelter in place" Food / supplies Oxygen Protective clothing Proximity to release	Contain spread of agent Bomb Chemical Biological	Debris Air quality (dust) Wind direction	Funding, training for hospitals Mobile hospital units (MASH)
Post-Disaster, MCI	[redacted]			

Post

Disaster or Mass Casualty Incident

Phase	1. Host (human)	2. Vector (biological, chemical agents radiation)	3. Physical environment	4. Socio-economic environment
Pre-Disaster, MCI	[redacted]			
Disaster or MCI				
Post-Disaster, MCI	Protection for emergency personnel (masks) Antibiotic therapy Vaccination Quarantine	Remaining radiation ... Spread of biologic agent (e.g. smallpox)	Emergency communication systems Decontamination center Coordinated EMS response Transportation for non-injured	Upgrade triage systems Coordination with Media Psychological/ physical casualty tracking

Generic Matrix for Disaster or MCI

Phase	1. Host (human)	2. Vector (biological, chemical agents radiation)	3. Physical environment	4. Socio-economic environment
Pre-Disaster, MCI'	[redacted]			
Disaster or MCI				
Post-Disaster, MCI'				

"And it was so typically brilliant of you to have invited an epidemiologist."

The New Yorker November 26, 2001

Haddon Matrix for a Disaster or Mass Casualty Incident

	1. Host (human)	2. Vector (biological, chemical agents, radiation)	3. Physical Environment	4. Socio-economic Environment
Pre-Disaster Or Mass Casualty Incident				
Disaster Or Mass Casualty Incident				
Post-Disaster Or Mass Casualty Incident				

Local Area Biodefense/Surveillance Meeting Notes
May 13, 2003
10 a.m. – 12 noon
National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

Baltimore City Health Department
- Daniel Barnett, MD, MPH (daniel.barnett@baltimorecity.gov)
- Nkossi Dambita (nkossi.dambita@baltimorecity.gov)
- Ruth Vogel, Director, Terrorism, Preparedness & Response (ruth.vogel@baltimorecity.gov)

Baltimore City Police Department
- Det. Lt. Rodney Giacomelli, Criminal Intelligence (Security Coordination) (Rodney.giacomeli@baltimorepolice.org)

Center for Total Access, Ft. Gordon, Georgia (via teleconference)
- Col. Warren Whitlock, MD, Director
- Willie Bido, Operations Officer
- William Bowman, Multimedia Programmer
- Angela Dingbaum, RN, MPH, Nurse Coordinator
- Kurt Huttar, Systems Analyst
- Edward Kensinger, Program Manager/Training Coordinator
- Jeanette Rasche
- Gay Thompson, RN, MPH, Nurse Coordinator

Department of Health & Mental Hygiene
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Dyncorp/DTRA (Defense Threat Reduction Agency)
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Federal Drug Administration (FDA)
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National Study Center for Trauma & EMS
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Office of the Governor
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- Nicole Chupas (Nicole-chupas@sbccom.apgea.army.mil)

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UM School of Medicine, Department of Biochemistry

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UM School of Social Work

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Dr. Mackenzie welcomed all present. Introductions occurred of participants (see cover page). Mr. Tom Lockwood, Advisor to Governor Ehrlich on Homeland Security then presented. (These notes are paraphrased) Homeland Security is a very personal threat. In the insurance industry, there is a different perspective to the hotel industry. If I were in Calvert County, Maryland, it would be the nuclear power station at Calvert Cliffs that would be the concern, if I was in Frederick County, they would be talking about Ft. Detrick – what would happen if ….. one has to look beyond your immediate community to understand peoples concerns (see attachment #1 for Mr. Lockwood's slides).

(Slide) I will discuss the challenges in the near term and the blurring of public and private boundaries, changes in expectations of planning processes, integration challenges. Information and intelligence sharing and changes in governmental culture will occur towards communication carries (slide). Industry is responsible for security systems on the whole – 80-90% of infrastructure is owned by private industry. Their responsibilities between public and private activities is not as clear as it was before 9/11. After 9/11, there was an expectation of other capabilities of the communication systems. The design threat – cyber terrorism in buildings or even hospitals. People are reassessing this. The question is what is the threat to such local, city, stand and federal assets. The significant policy issues of these changes are – who is going to pay for this. For the airline and the maritime industry and nuclear power, the increased security costs are enormous as well as for governments and these need to be resourced.

One of the key issues is going to be the balance between security and our constituents "right to know" in a democracy. The next challenge is not knowing what the threat is – one cannot prioritize resource allocation when the threat is unknown – when it could be a virus, a chemical or a bomb. We are now much more concerned with outcomes of threats, rather than whose problem it was that the threat was unrecognized, i.e., CIA/FBI, etc. The relationship between licensee and regulator in, e.g., Nuclear Regulation Commission (NRC) becomes blurred – the security of these facilities needs collaboration and emergency response capability. If the licensee has an undesirable outcome, even though they have done everything, NRC required that they may still lose their license – then we have a problem replacing that lost energy, (Slide). This leads to a need for integrated capabilities, e.g., Federal/state/local integrated law enforcement and defense. Environmental or natural resource monitoring requires integration of FEMA/MEMA/MD/DC/VA activities and coordinated responses. (Slide) Information and intelligence sharing – uncertainty in the real environment – security/terrorist operations have been prioritized over other efforts such as drug operations. One of the problems is that each agency has different rules for sharing information. The amount of information received from federal agencies may be limited – we need to emphasize information sharing – reinforce these modes of sharing around the state. In private industry, I would go to the caucus gathering places such as the hotel industry, Hospitality Association for hotels, (slide) Capabilities of the private sector are underestimated – how do we use and gain access to these capabilities and individuals – we want to make this inclusive and leverage the world class assets in the region. (Slide) How many agencies were involved in Homeland Security (HS) – over 120 – but only 22 departments and agencies are now in the Department of Homeland Security – i.e., over 90 are left out. As

a result, mission, vision, and culture and infrastructure of these 22 departments and agencies now in Department of Homeland Security are going to need to change and become one blend. Attributes of agency, e.g., uniform, history, legacy will have to change and pull together – it will take years and not occur overnight.

Instead of looking at DC, MD, VA as separate regions, we are trying to look at them as an integrated whole. National Capitol Region (NCR) is a prime target community; Different states have different approaches to Homeland Security. Some have large shops with a Director. Other states have small shops, others advisors – there is no consistent model to follow. Whatever we do, we have to breakdown the divisions between organizations within governments. Barriers within government and within professions - meetings such as this allow you to function as a single group to caucus. Our open society with open access leaving us vulnerable to breaking of this trust and changes in personal liberty are problematic for this country. What is our measure of threat, can we consider only attacks that occur or do we include possible attack threats or ones that are thwarted. One of the tests of infrastructure was SARS – we do now have people sharing information. We need forums where we can focus our priorities for responding to such events.

How many Biosensor projects are there in the State? We have to integrate efforts, UMCP, JHU, NSC, etc. what are they doing. Planning, screening, exercises requires contribution from a coalition of partners for table top to full exercises – Questions?

Q: Long question concerning boundaries, information transfer between agencies, etc. – (speaker – a long way from microphone – not clear).

A: Everyone should be accountable and responsible for their particular job if an integrated and coordinated outcome is required. If we are going to have fiscal accountability for those people that are providing the resources, e.g., taxpayer, we need to have an integrated outcome while recognizing jurisdictional concerns.

Q: (same distant speaker – Question not clear)

Comment: We have had a meeting with the City staff, State MEMA to discuss integrations of this demonstration project with these other agency activities.

Comment: There is something to be learned from the military, e.g., if you get groups together, there is always a "Lead" person – in the case that we are currently discussing, it would be the Director for Homeland Security. If we take each agency and have them define t heir mission and scope of work as Homeland Security based, then every jurisdiction that falls under that umbrella will integrate their outcomes.

A: So that you are aware of a piece of information – the Office of Homeland Security is starting to use common terminology or tools – so that when Howard County or Baltimore City wants to describe a threat assessment, what tool do they use. The National Capitol Region is going to be a testbed for a threat assessment tool – All N. VA, DC and two MD

counties around DC will all coordinate through this threat assessment tool – this will be the first time they are doing this regardless of jurisdictional boundaries. The lessons will be learned in the next 45 days. The output is required for FY 04 Department of Homeland Security funding. The rest of the nation will receive this threat assessment tool in July.

No further questions. Next speaker, Captain Marcus Johnson from SBCCOM, Aberdeen Proving Ground, Chemical, Biological Rapid Response Team (see slides at Attachment #2). First Captain Johnson showed a video on communications and mobile communication networks via satellite. Adhoc self-contributing networks and all deployed forces including the individual vehicles and soldiers are part of network cells that are fully interconnected and mobile. It allows communication in diverse environments and dropping of sensors into enemy territory to detect potential targets and relay back to command and control and allow in flight re-direction of missiles, etc. The intent of the video was to relay how military communications and Command and Control planning could possibly benefit Homeland security operations including Hazmat teams, satellite use, mobile communication – improved HF radio – UAV's (Unmanned Aerial Vehicle) via aircraft cover wide land footprint (cheaper than satellites). Homeland defense personnel can be identified more reliably with aerial C2 systems. Sensors can be placed in contaminated areas and provide data. Information processing, utilized and assessed by incident command and control – integration of command. Slide 2 – highlights – aerial, satellites HF Radio Contingency Planning. Slide 3 – Information feedback Outside Continental U.S. (OCONOS) and CONUS. Slide 4 – Short-long (100 ft – 20 miles) range communication. Slide 5 – HF radio – single channel back pack band width for video is important. Slide 6 – Situational Awareness and Understanding using voice video data system. In hospital environment, it would be other hospitals, BCFD, police, etc. Q. What do you need to know to succeed? You need to be able to manage the data and synthesize it so it makes sense for you and aid in decision making (<u>what are you going to do as a result of reviewing this information</u>). (Slide) Command and Control can make a better decision. (Slide) Communication capabilities – make the software vendors give you what you need. (Slide) Communication planning – what equipment and personnel do you want to maintain and retain? Urban challenges due to buildings/network cells/power capability. Triage location should be communication compatible. Simple Communication doctrine=higher/lower, right and left (slide). Sample command and control structure. A forward deployed medical support team from the hospital Operation Center. Maintain communication with these groups. It is imperative that the Operations Center maintain communication with the medical support teams at all times. The hospital operations center then provides information to the city operations center and then to the State level and so on and up. It is a good idea to have all forward deployed medical support teams hear what is going on. Inter-operability of communication systems helps this occur. (Slide) – problem with communication around concrete and steel. Mobile platform can extend the command and control reach – data+video+voice. DRAGON – imagery, log, and processes request for information and assistance, designates tasks and monitor tasks – has a code to identify when someone has accepted the task (red/yellow/green). It could be commercially available (Geo-centers is company that operates DRAGON). Slide. DRAGON provides imagery such as this of

the Pentagon, green star=hospital. Sites one, two and three are triage locations – other areas such as schools, churches, etc., can be identified. (Slide) Communication system – stay away from legacy systems – lease rather than buy is an option. Satellite phone is simplest (Slide). Sabre radios – simple, small all hand-held control frequencies, range uses, limitations, (3 km) need repeaters on roof of buildings (slide). Medium systems Inmarsat Nera world in brief case - would only be charged for access when used $6-$11 per minute, laptop added = cost more "Scotty". VTC/data (30 lb) unit – all in one, but needs to be connected to a transmitter – can be plugged into Local Area Network or with Inmarsat Connection – Slide Inmarsat more sophisticated – antenna more directly pointed. Higher band width. TD Comm. (Slide) Network tie in. Communications bridge allows one to tie in different radio systems, i.e., police and EMS and other agencies can allow inter-connectivity – can dial out of command and control to hand-held radio from phone. Large system communications systems are also available; for example, the System Expedition (developed by Global Communications Solutions) – everything they need can be plugged into the truck. Conclusion (Slide). Operation should have communication to suit it. Need to know what you want. Small system, fewer maintenance costs. Questions? (difficult to hear on tape).

Q: What are the effect of electro magnetic waves that might paralyze communication systems – what do you have as a back-up should this occur?

A: I will find this out for you – what research has been done to protect against electro magnetic interference.

Comment: The emergency management plan has a communication system that are shielded. Normally only found in fixed facilities.

Q: How does the inter connection system work?

A: It allows different communication modules to be connected into a common output.

Q: How is data connected from a sensor network to command and control in a non-military domain? How would you get data from sensors in a non-military environment?

A: We are working in the CBRRT with something we call Remote Telechemistry – we can take control of a device, after sample put in, an expert 200 miles away can manipulate the system and interpret the data. We would communicate back to on-site command and control via video or we would incorporate ourselves into the on-site communication cells.

Comment: One of the things of value would be to define the operation and then you would know what your communication needs are.

Q: Ft. Gordon – linking up with military communications. Information already discussed.

Q: What UAV – UHF – systems do you use? Sorry this is a sensitive area. Q: Can a local package be added? A: Yes sir. Virtually anything can be added – the challenge is getting time to utilize the UAV – Q: Is there FCC license requirement issue? A: There are some frequency challenges – every community has a frequency manager – worked out with that person/FCC. Q: JPS bridge. Is it a commercial item. LTC. Grove, Maryland National Guard, - It is an ACU 1000 – General Dynamics recently acquired it – though JPS is located in North Carolina – ACU 1000, a systems integration device.

Any other questions.

Executive decision to pass on the last presentation on Haddon Matrix – we will distribute data on aggregated responses. We would like you to add comments as homework for next meeting.

Dr. Mackenzie expressed thanks for the time and effort everyone put into the Haddon Matrix data – some great ideas came out as a result of this. The summary of the aggregated data is attached (Attachment #3). Dr. Mackenzie announced that the presentation on the Haddon Matrix for Sarin attack will be at the next LAD demonstration meeting in June. Ft. Gordon acknowledged receiving the aggregate data – 12 slides showing each of the cells in the Haddon Matrix framework.

Dr. Mackenzie then introduced Carrie Burmaster, Director of Counseling, and University of Maryland School of Social Work, who will talk on mental health findings from the Freestate 2002 exercise. Carrie Burmaster's handout is attached (Attachment #4). There were no slides in her presentation.

Ms. Burmaster started by introducing herself as the co-Chair of the Disaster-Mental Health Committee that has formed on UM Campus as an on-going effort. A core committee was formed that included representatives from UM professional schools, UMMS and VAMC to develop a common coordinated plan that could be used throughout campus by these three systems. We have a drill (Freestate 2002 – July) in which none of the people in the drill had been credentialed internally because this process was not fully developed in July 2002.

What was done in this exercise and what was available was then described, and later some findings were discussed. Mental Health (MH) personnel were available at various different points throughout the drill – the post decon site – we could not go to the pre-decon area because none had been trained to wear the suits that were needed. The triage site, medical treatment, holding sites, ER, STC. Established a MH holding area in STC auditorium with objective to escort MH individuals to this holding area and keep them there until disposition - client found or ready themselves to go home.

We attempted in MH area to track and find loved ones (not very successful at all), notify loved ones of death (also not successful). 16 volunteers – interdisciplinary staff consisting of social workers, psychiatric RNs, clergy, Child-Life workers and psychiatrists. Labeled themselves with label, 'INFORMATION' as opposed to

counseling, or MH – felt people more willing to approach with information label. Supplies and equipment were very basic – one radio – to communication with command center – no one on scene had any way to communicate with each other – a major, major problem! We attempted to use runners, but proved unsuccessful because by the time the runners got to where they were sent, whatever was going to be reported had occurred and was done with. More communication devices were needed. At one point, a big upset occurred in the decon area and many MH workers were requested to go to that site – by the time they had notified maybe two MH people, the whole exercise was temporarily stopped! In the MH holding area and various other areas we developed handouts on stress reduction, what to expect, etc., games for children, candies to give people, log-in sheets, paper and pencil, puzzles. We had rudimentary supplies.

In terms of what our significant finds were:

1) Very busy – at least 60/250 walking wounded – a few additional contacts were not reported.
2) Staff was overwhelmed. "Victims" coached very well to be hysterical/screaming/panicked/uncooperative. Difficulty managing people.
3) Difficult to contain them to mental health holding area – difficult to prevent them from walking off – in fact, directly opposite one control room – they kept interfering!
4) Room had multiple doors – need better control of entry and exit – people wanted not to stray, but to look for loved ones. More security,
5) Better education for MH workers on crowd control as this was a major issue.
6) No information was given to MH workers about where to find people or where to locate relatives – victims were coached to not be satisfied until they got information. Anxiety and panic escalated as MH workers could not find or provide information.
7) Identities, time of deaths, deaths that had occurred were not available to MH workers throughout entire exercise.
8) One large MH holding area was not optional – many different functions going on in same room – needed their own triage area in MH. People with many different needs – one person's needs impinging on others.
9) Separate areas needed a) for children - contiguous with a family area, b) victim area with primary need to receive mental health counseling, c) disruptive people needed segregation, d) death notification.
10) Not enough activities to keep people occupied in MH holding area – it would be helpful to better manage emotions.
11) Food – only candies – real food and water is needed especially for children.
12) Blankets – sopping wet people in air conditioning got very cold.
13) More MH presence in decon area. This area tended to be problematic – a couple exhibited psychotic symptoms going through decon. One death occurred pre or night at decon – caused mini panic – more people away – very emotional place in need of more MH support. Same hold time for triage area. Some people needed to be strapped down to bed because they were uncooperative. In triage a problem.

14) Information and personnel tracking needed big improvement. MH had no ability to track where people were. This was mentioned by many people.
15) More transport - 10-15 people at a time from triage area to MH holding in STC auditorium required waiting, long trip through elevators/halls, etc. All 15 people did not want to do this – they wanted to search for loved ones themselves – only one person could not control them during transport.
16) During exercise, MH issues in volunteer staff were not addressed – this needs attention – in a real situation, that would be a major need as well. Actual MH staff needs attention like victims.
17) Credentialing – we did not have a common approach. Ms. Burmaster is involved in a committee with JHU and we are interested in developing a common training and credentialing tool that would be brought in throughout the State (? Plan to test in LAD Demonstration) – working with DHMH to train a cadre of volunteers in same way also Red Cross MOA.
18) On campus, VAMC, UMMS and campus using the same model of credentialing and training.

Questions:

Q: What is being done to address issues of food, water, blankets, etc. in holding areas? Also communications.

A: Issues include: who is going to pay for this? No well designed system between three entities on campus. Debriefing occurred after drill and teams are being formed and we are talking. VAMC training – excellent. School of Social Work is developing a curriculum for DHMH. We are clear on what we need in terms of resources – w hat has not been resolved is how to get them. Comment: Lessons: 1) Emergency Medicine Plan – revised – priorities established, 2) dual use capability – usual – A: cont'd (turned over tape here) dual use is part of our strategy. Linda Pelletier is helping organize the Emergency Response. On the Command and Control front – a recent table top exercise working with MEMA to do an annual exercise will enable some of these other things to sort themselves out. The more people like Carrie we have working on their piece the better. We have to get command and control from the top down working together.

Comment: Julie Casani, MD. A couple of observations – It was interesting to get real numbers about how many MH casualties there were – it strikes one what an extraordinary number it is relative to the physical casualties – yet we spend so much time, energy, effort and resources on physical casualties and no resources on MH casualties – part of that is that every casualty is a MH casualty as well so your comment about getting MH triage right up front in the Decon Center is fascinating – in fact, some of the people going through Decon – the MH issues are more critical than the non mental health issues. The whole concept of a MH triage system is intriguing – a PhD thesis right there.

I have learned from other search and rescue efforts I have been on that it may not be possible to get a family member face to face, but it is possible to et them radio-to-radio or on the phone. Another resource that you may want on your list is radio that can allow a

family member in the treatment area and one in the MH holding area to talk. That voice is as comforting as anything. Video high tech may also be possible to utilize that. Reading material requires a certain amount of focus and attention which is not possible during such as event. Videotapes may, however, be useful – position some video players around so people can sit and watch while everything else is going on.

A: Yes, we had discussed using regular videos to keep MH casualties busy.

Comment: I don't know whether you have considered tying in with public information channels. These channels are putting out the same information as is being heard on the outside. So that a new arrival will not show up with "new" information.

Q: I don't know what is currently being used – but would it not be simple to use a bar code and bar code reader on people coming in.

A: Yes. Coming from the field – in triage, they should have a tag – we are getting ready for exercises in July in Prince George's County in which we track patients from the scene – we are trying a wireless solution for this. This will be networked among all sites. Once the casualties get to the hospital, then this could be bar-coded into a hospital system. That is the next step to see how the field system could be incorporated into the hospital system. The problem is I can do it for one hospital, but what about all the 49 other hospitals in the state. Each hospital has their own information system/medical records that are not compatible between each other.

The inter-operability not only between field and hospital, but between field jurisdictions, between hospitals, etc., is the issue. It is going to take some significant money to interface all the different systems that are out there.

Ft. Gordon. Questions to the group. 1) The wireless network utilities are going to be limited. 2) The scanning of bard codes – there is a standard in use by many states on the PDF472 as an encryption tool developed by DOD and is a standard on the old ID cards and new common access card. We look to encrypt in 2007 as modification of an Air Force system utilizing encryption software and a handgun scanner to scan the PDF 417 in two seconds – take that information which is the newest data in a legacy database and insert it into a SQL database for information sharing – that sort of technology is on the back of your driver's license. This is one of the techniques that the Center for Total Access is working on for tracking not only patients, but also health care workers from a force protection stand point.

Comment. That sounds very nice. In the military, there is some integration of these data. Unfortunately, in the civilian sector, just in Maryland, we have 50 different hospitals – our problem is not necessarily being able to read the information off a driver's license – our problem is being able to integrate all of the system. With HIPPA, that is going to make it even worse and more difficult to accomplish.

Dr. Mackenzie then summarized a request to participants to comment on the aggregated document of the Haddon's Matrix. Each of the cells in the matrix is presented on a separate slide. We would appreciate your comments and suggestions on this matrix. Homework task is to fax in additional comments (Fax # (410) 328-2841) by Wednesday, May 29th.

Comment #1: Definitions will be included in the e-mail with the aggregate data of the Haddon Matrix to clarify any confusion about what goes where.

Comment #2: On the Matrix, you will see some of the portions that are referred to as "modifiable" – those are the ones that are the potential to improve in an exercise or the real events. Comment on how you would change them.

Next Meeting: Tuesday, June 3, 2003, 10-12 Noon.

Ft Gordon comment: Many of the same issues are being confronted – inter-operability between local, state and federal agencies.

5/13/03

COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE (C4I)

Soldier Biological Chemical Command, APG, MD
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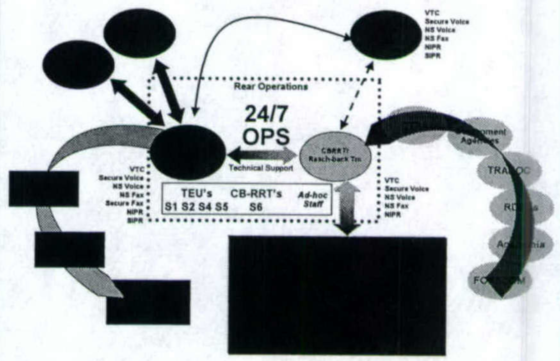
COMMUNICATIONS PROPOGANDA VIDEO

[redacted]

COMMUNICATIONS PROPOGANDA VIDEO (Captured Highlights)

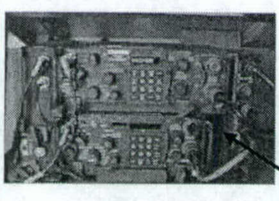
- Long range communications
  - Aerial systems
  - Satellite
  - High Frequency Radio

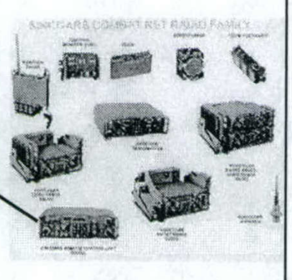
INFORMATION PLAN USED BY SBCCOM



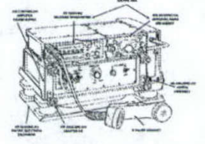
ARMY TACTICAL SHORT RANGE COMMUNICATIONS

Single Channel Ground and Airborne Radio System



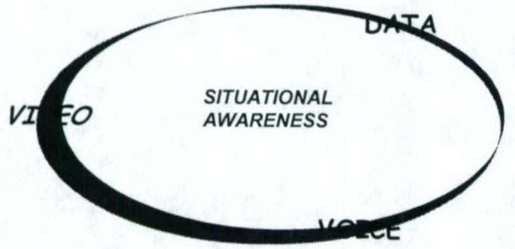


ARMY TACTICAL LONG RANGE COMMUNICATIONS

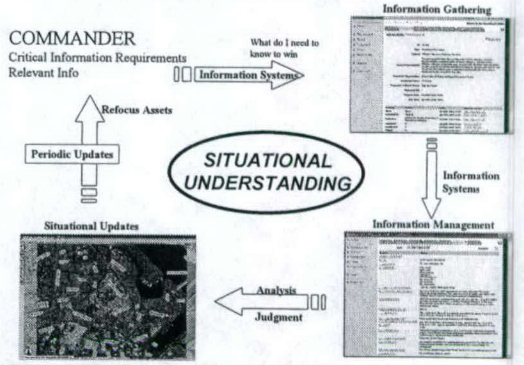



AN/PRC-104 Radio Set

SITUATIONAL AWARENESS & SITUATIONAL UNDERSTANDING



SITUATIONAL AWARENESS & SITUATIONAL UNDERSTANDING



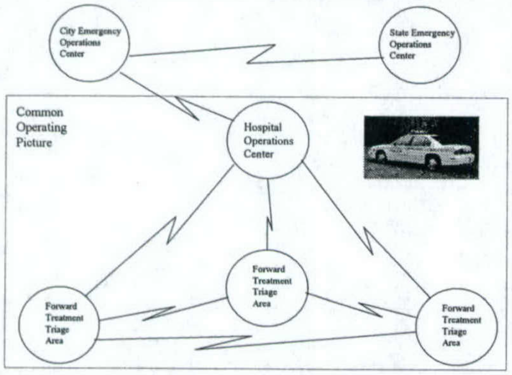
COMMUNICATION CAPABILITIES

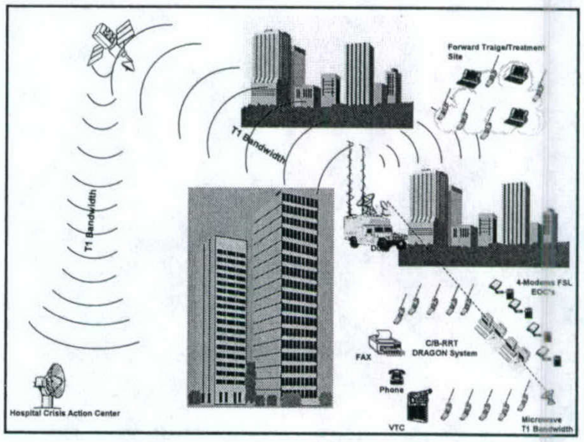
- Manual or automatic
  - Messenger and runners
  - Vehicle, Air or Manpower
- Unsophisticated devices and machines
  - Small portable satellite phones with minimal data capability
  - Medium size satellite devices with average voice and data capability
  - Large scale systems that are sophisticated and handle large amounts of voice, video and data
- Data Packages and Software
  - Thousands of software vendors
  - Must really understand, comprehend, and interpret your needs

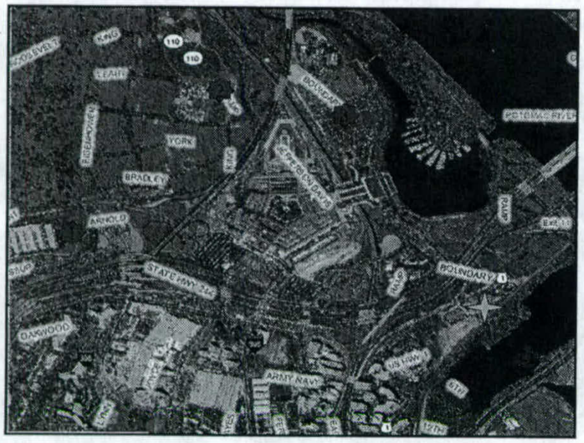
COMMUNICATION PLANNING

- How much to you want to maintain?
  - What resources do you plan on retaining?
  - Outsource some requirements; serve agreements
- Privacy rights of patients and casualties
  - Security in communications (military term: COMSEC and OPSEC)
- URBAN Challenges
  - High rise buildings
  - cell phone networks (cells)
  - Power (particularly in cases of mass destruction)
  - Mass casualties and triage locations
- Simple doctrine
  - Higher and lower
  - Lateral

SAMPLE CIVILIAN C2 STRUCTURE







SMALL SYSTEMS

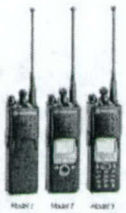
Motorola Satellite Phone

Iridium 9505 Satellite Phone

Motorola Portable Dock

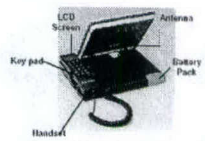
Qualcomm Satellite Phone

SMALL SYSTEMS



MEDIUM SYSTEMS

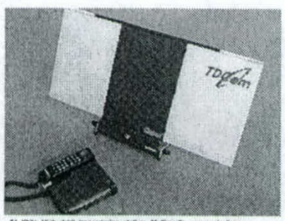
Nera WorldPhone



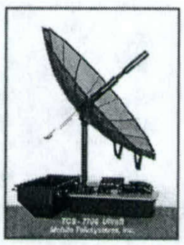
Thrane&Thrane Capsat

Scotty VTC/Data Unit

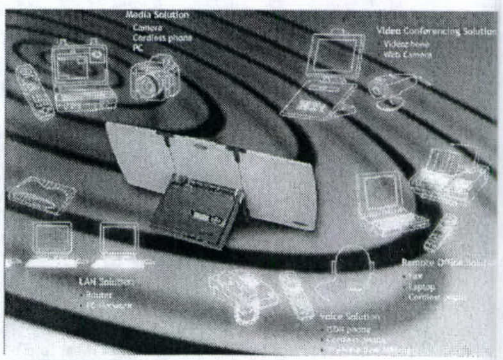
MEDIUM SYSTEMS



64 Kbits High debit transmission station. Multimedia communication system based on 64Kbits high debit Inmarsat communications. Enables to do videoconferencing, pictures transmission, fax, voice, data.



NETWORK TIE-IN



LARGE SYSTEMS

LARGE SYSTEMS

LARGE SYSTEMS

CONCLUSION

- Operations dictates the communications plan
- Communications systems run from small and unsophisticated to large and sophisticated
- Software and Information Management tools
- Maintaining equipment and personnel.
- Coordination with other organizations.

June 3, 2003
10 a.m. – 12 noon
National Local Area Biodefense/Surveillance Meeting Notes
Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

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Dr. Mackenzie welcomed all attendees (see cover page) and they introduced themselves. He then introduced the first topic on Haddon's Matrix methodology applied to homeland defense. This topic was not presented because of time constraints at the last LAD meeting in May. This approach was used as a tool to look at all the preventative opportunities against terrorist attack, to prevent injury during an attack and to assess what needs to be considered after an attack. Thanks to the efforts of you, the attendees, we have obtained responses that represent 15 different agencies and multidisciplinary opinions. The aggregate data from these responses was next presented by first, Jon Mark Hirshon, MD, an emergency medicine physician on the faculty of the National Study Center for Trauma and EMS (NSC) and Major Shawn Varney, MD, USAF.

Dr. Hirshon started by identifying this approach as an extending injury prevention methodology to chemical terrorism, specifically looking at application of Haddon's Matrix applied to Sarin gas. Those involved at the NSC include Drs. Colin Mackenzie, Jon Mark Hirshon, Shawn Varney and Patricia Dischinger - we appreciate the input received from your perspective and expertise. To review the matrix (see Dr. Hirshon's slides as attachment #1) - it is a way to look at an event and find ways to prevent injury from that event. The concept is to look at the event in three time frames (pre, event and post event) and break the time frames into different injury associated factors. Different factors are the host, agent (vector), physical and socioeconomic environment.

What Haddon's matrix does is that it combines these factors in the environment that change with the concepts of primary, secondary and tertiary prevention of injury. That is injury from Sarin. The phase description include: pre-event factors are t hose that cause "energy" (as in the original description) and determine whether an event will occur and can be mitigated to minimize its effect before the event occurs. Event: where the actual "energy" exchange occurs - where the Sarin and the individuals involved interact - and the likelihood of people experiencing symptoms from Sarin (i.e., whether injury results from the event). Post event: describes factors occurring after the influence of the Sarin gas (energy release) - the EMS responses, antidote use, etc., etc.

We provided you the background to the Haddon Matrix methodology and gave examples. Then we took a specific case scenario (Sarin gas) with parameter, wind direction, time of day, etc. When we got people's responses back, we looked at ways we could differentiate responses by whether we could modify or change these responses with an intervention or whether the factor was immunable. A lot of the factors were behavioral, perhaps collaboration, education or exercises. Engineering (structural/technological) ways to modify injury were also considered. Finally, we categorized as a systems response that provides the background in our approach to these data.

Major Shawn Varney. We are going to talk about different ways we can impact. The event begins when people start experiencing symptoms of Sarin gas. How can we immunize the injury severity even after the event occurs? The "laundry list" of all the responses was coupled into the Haddon Matrix format to make them easier to digest. Pre-event responses (See Dr. Varney's slides as Attachment #2). The items that are potentially modifiable are labeled with an asterisk on these slides as items 1, 2, 3, a, b, c.

Number one is a behavioral/education training modifiable item. Number 2 engineering is and number 3 is a system response. The modifiable ranking is open to interpretation - this is an effort to simplify...

Comment #1: A most important asset is the ability to rapidly detect, to identify the agent and to respond to it. Under communication, I would like to see the word "radio" removed - there are important other means of communication including face-to-face, etc.

Comment #2: Communication at the local level is very important especially when it is difficult to know what is going on and how to respond as a unit. How does one coordinate these efforts?

Comment #3: Unique to the rapid response aspects of this proposal is that we have 5 rapid response teams right here on campus. This is part of our incentive to look at that question of situational assessment and information sharing. How do we mobilize these teams to respond to a local event on this campus? We are getting a sub-group of the rapid response teams (RRT's) to meet and discuss coordinating their efforts. We have 1) Shock

Trauma Go Team (trauma/bomb explosion), 2) Environmental Health Services Team (HAZMAT trained) 3) OCME Hazmat training 4) USAF - C-STARS team with decontamination facility 5) The MIEMSS EMS Team which is HAZMAT trained 6) VA Medical RRT. - So 6 RRTs on Campus.

Comment #4: A point that comes up again and again in the State Medical Society - the last bullet on this slide below EMS should be "practitioners" - this is a huge issue at this time.

Comment #5: Besides the formal Rapid Response Teams (RRT) on Campus, there are also other entities - the hospital has other teams that are not the RRT - it has the Disaster Mental Health Team - these all have to be included too.

Comment #6: The key thing is the integration of all these - understanding which part the hospital covers, which part other agencies on Campus cover.

Answer: A lot of these comments can be worked out in preparation for drills - this is one of the planning processes - who has the responsibility for what? 80% of the benefit of an exercise course from the planning process.

Slide on Vector: Sarin, itself- (see Slide #7). Antidotes, correct diagnosis and treatment. Access to buildings, heightened sense of awareness/HVAC access, etc. How stringent are the restrictions on getting hold of or obtaining the manufacturing ingredients for Sarin.

Slide 18: Pre-event physical environment. Broadly, from individual to the environment. Evacuation issues - security issues. Personnel accountability - someone should be responsible for this. Structural factors - although we cannot change buildings location of air intakes or drains - maybe a secure area can be made around these structures so that they may be, e.g., only access from above? Engineering changes - decontamination facilities - fixed and mobile communication interoperability - frequency commonality - city/police/EMS, etc. Sensor availability - one of the things that will be occurring is deployment of real-time sensors. Incident command (IC) - establishes chain of command - IC equipment and portability is an issue.

Comments: Next LAD meeting will involve a discussion of evacuation of the Campus. The software packages were handed out. (National Atmosphere Release Advisory Center (NARAC) and ADASHI from SBCCOM). A tool for rapid campus evacuation. We are working with Col. Barnes in Public Safety to use the campus security camera as a source of situational awareness during the LAD Demo. This approach has generalizability to many other local areas that are potential terrorist targets.

Slide 19: Socio-economic environment. Both individual and community issues. What kinds of symptoms are associated with which agents - this information could be available on an Internet site. Flash cards available for Emergency Responders. Education and behavior modification. Mental health impact - rumors can be controlled by providing accurate information and good communication systems - essential to mentally survive these chaotic situations. Personnel protective equipment needs to be stored in known areas - money and space required - is the benefit worth the risk of attack? At the community level training exercises v. important - optimum and creative budget expenditures. The way the media communicates can greatly impact the public perception of the capabilities of the authorities to manage situation. The message being the leaders are not panicking, the situation is under control - gives a sense of calmness and confidence. No audience comments on Slide 19.

Slide 20: Event Host - capability of providing airway from the view of the ED, from the hospital. How quickly can one lock down a facility or an area? Can rescuers get to you?

Q: The event start - when do you start, and also when is the event considered over?

A: There may be multiple events - There may also be secondary contamination from clothing by off-gassing. The dividing line to define the end of the event is not really clear, however, when the individual's disposition to an ED or definitive care is initiated, the post-event status now prevails. It is a continuum.

Comment #1: Theoretically, the constraint is when the energy has

dissipated. From a gas or chemical perspective, I would think it would be when the effect of the Sarin has occurred. A single event is rather artificial as it is followed by a lot of smaller events.

Comment #2: In the Sarin release in the Tokyo Subway, there were still people arriving at EDs five days after the event.

Comment #3: As regards to the vector - how long is the Sarin going to remain in the environment is clearly a factor on when Sarin effects actually end.

Comment #4: The issue of access by rescuers is extremely important at the local level. The recent episode where aerosolized Fentanyl was used in the theater demonstrated the problem. The nearest any rescue personnel could get to the theater was about 200 yards - so all the unconscious victims had to be carried a large distance through a mass of obstructions. On this campus, we have a massive ability to block entry and exit from this campus. So working out an appropriate approach for rescuers to get in is an extremely important part of this LAD Demo.

Comment #5: In the pre-event slides, we should include "historical data" from previous events.

Q: Dispersal - how vulnerable is a building?
A: The engineers, facilities management and those who know how the building....A lot of the information needed can be made available in training and by knowing who to call.

Slide 22: Physical Environment. There is so much to cover, you will see repeated items on this slide - clothing - evacuation, building - decon area - how will we demark this - does everyone know where it will be - is the hospital closed to outside traffic or receiving more and more people.

This is an issue in a decontamination exercise this week. Trying to place tents so they do not interfere and minimize impact on everyday operations. Communication - PDA, radio operations.

Comment #1: Can I make a suggestion that we eliminate the word radio -

interoperability means discussing it - it does not need radio - it could be face-to-face. Radios may be impractical since in a bomb attack where RF black out - other means are needed.

Slide 23: Socio-economic event individual 5:1 ration worried wounded v. injured patients. Aerosolized Prozac? Fentanyl? Institution, incident command, community drills - use of internet - digital photos of all victims to follow them through the system. EMS has tools to check whether agents are present, check radiation with Geiger Counter Education - Video News Releases on particular agent for the media.

Comment # 1 & 2: Who is going to look after the psychological casualties - for a radiation event, this is a major issue. The second comment is to reinforce the correct information especially when there is ambiguity. Need an authority and pre-prepared news information.

Comment #3: Radiation issue - levels established by the government are unrealistic for radiation attack - they would not let anyone stay in the zone? Are we going to say whether someone has been exposed on the basis of some government numbers?

A: That is the $million question - risk-wise is quite different from regulation.

Slide 25: Post event vector. Measure AChF level – triage tool institution. Community decontaminate – clean up decontaminant water.

Q: Is this somewhere we could think about the Brentwood model? The fact that in many people's minds, this will always be contaminated.

A: Certainly, this is an important psychological issue.

Comment: With Sarin, its dispersion can cause it to become very diluted and an hour later there can still be Sarin.

Slide 26: Post event – physical environment, individual/institution – back-up emergency medical resource center – community issues (tape change here).

Comment #1: What about availability of supplies, food, water. Family communications should be added to this slide.

A great idea – ways to link via email, phones, etc.

Comment #2: How much storage is there in the hospital cafeteria? If weather closes the place down for three days – how much have they available – not just for feeding "patients – but also visitors, hospital and campus personnel.

Comment #3: Evidence collection – should be included – e.g., clothing in this slide.

Slide #27: Post event – socio-economic. Record loss issue.

Comments: 2 comments – 1) there needs to be points identified for follow through events and solutions, politically can move on this; also 2) hospitals keep very low inventories – just in time – even in military settings. The Maryland Hospital Association should be contacted.

Comment: As a caveat: In radiation attack, you do not want to evacuate – you want to stay inside buildings to minimize exposure, but nonetheless, the risk is still low.

Comment: In a mast destruction terrorist event, the rules may change and less stringent restriction.

No comment from Georgia.

Slide 24: Post-event Host. Pharmacy stockpile – MOAs – we need a way to collect information and make it accessible to the public re: data gatherings and communicating the information. Computers may be down in a disaster. In the post-event, in the ED, what are we going to do about airway management – the walking wounded.

Comment #1: Aren't MOAs meant to be in place before the event for them to be useful?

A: Right – once it has occurred, the relationships you have in place can be called upon.

Comment #2: What we are looking at is a cycle here. Post-event is in one perspective the next pre-event.

Comment: It is not simple straight forward or B & W. There is a lot of crossing over.

Comment #3: You could add a lessons learnt category. If you do this, you will better understand what relationships should have been included in this – a debriefing post-event.

Comment #4: You should consider the human vector in all of this.

Comment #5: 30% of emergency hospital providers and 10% of first responders in the Sarin attack in Tokyo showed symptoms of Sarin poisoning from contamination by clothing and tell MHA what to expect.

Comment #6: One issue discussed for a number of years is the capacity for emergencies. In the health care industry, excess capacity has been eliminated for financial reasons. It is now as needed 'supply side'.

Comment on the last remark 1) JACHO has brought in some new standards that will address this next year or the year after 2) Nelson Sabatini will be meeting at the end of this month to address this statewide crisis. One of the discussion points is what are the psychosocial fallouts of a terrorist event when the EDs and resources are backed up even before such an event 3) to do this exercise is well and good, but there are real-time challenges now that need to be addressed.

Slide #28 (summation): 91% (96/105) were behavioral and most modifiable, engineering 33% (33/105) and systems related 5/105 (5%).

Slide 29: Haddon Matrix is a mechanism for trying to decide how ready we are. It emphasized the need for education, training and collaboration exercises. It identified potentially modifiable risk factors to reduce the

injury and its severity.

Slide 30 comments about command and control – chain of command and critical communication needs.

Comment for Command and Control is identifying who is in charge. In a mass casualty, need to know who is the leader – so when the word comes from that person – that is what needs to be done. This needs to be included in pre-event planning.

Comment – some offices on campus have not been included until recently in this planning process and leadership role.

Comment – Mental health persons should be included.

Georgia comments: none.

LTC Jim Grove, Director, Homeland Defense, Maryland National Guard was introduced as the next speaker. A Marylander was just sworn in as the Chief of the National Bureau. General Steve Blum, he is an ideas man. LTC Grove then started his slides (see Attachment #2) – organizational chart and military support curtain authority (MSEA) oversight responsibilities were shown (Slide 2 & 3) anti-terrorism/physical security (slide 4) and civilian/military innovation readiness training (slide 5). Anti-terrorism task forces were identified in slide 6. The Maryland Information Analysis Center – 3 military intelligence personnel to obtain information to protect our own forces. This is law enforcement sensitive information for the State's Attorney's Office in Baltimore – that information is prepared and brief and shared daily and weekly – follow trends.

As Tom Lockwood talked about last month, we do the intelligence for the Counter Drug Program. Communication Initiatives (slide 8) is one of the bigger areas in which we are working to provide one solution for all states – interoperability of information communications. The Maryland Emergency Management Agency is working on a statewide repeater system in which radios mobile repeater – bring together the different agencies in a single command post using a single communication system. All State agencies can talk to one another at the response scene (e.g.,

incident commander needs State Highway – can contact them over one radio network). We will have the authority to use this whether it is WMD or a hurricane. We are working on a joint initiative with NASA using a Nextel/GPS/JAVA script platform. One should be able to go to a disaster scene – use Nextel phone with JAVA and transmit information that has GPS location – transmitted to Incident Command or Command and Control with Java Script information, i.e., damage done, casualties estimate, etc. We are working with Anne Arundel County – patching into 800 MHz link. Using a single communication system will make this easier by swapping into the TC 1000. General Dynamics System "Guard to Go" and "Rediguard," plus MDNG is working with Anthean Corporation in Alexandria, Virginia using GIS (mapping program) with EMAC – same emergency reporting system that they used for the Olympics. The GIS will help the incident commander. MDNG also working with George Washington in the capitol area, CAPWIN (Capitol Wireless Integration Network) VA/DC/ND. Slide #9 – current communication, MSP, DNR, Syscom, etc. AM SSB (ALE=phone call via ham radio) frequencies moving back and forth – system chooses optimum available frequency. Mobile detection is something the University of Maryland may want to consider. EMA has these radios – just need to be willing to pay the service provider. GETS – Governor's Emergency Telephone System. Priority service cell override (comment from audience – in emergencies, this does not give you priority). With GETS – if the receiving station is busy – you will not get through – it does not knock someone off the phone to get you through. Slide #10 – National Guard Response Plans will be finalized by the end of September. Some exercises in planning first weekend in October – multi-model exercise at State Center - high explosive device and biological simulation. Strategic national stockpile access (next Spring '04). Military Intelligence Battalion working with North Command and US Public, DMAT one is the way the University can tap into the MDNG with an exercise. The MOU with USPHS will allow this to happen. DMAT one brings to the table preventive medicine providers and health care providers. MDNG can collaborate with neighboring National Guard and they are working with Defense Threat Reduction Agency (DTRA) on Critical Infrastructure Assessment Training. This will allow the National Guard to help identify the weaknesses apparent during exercises. JANUS – part of the Baltimore City exercise – working with Baltimore County to test JANUS in a

computer simulated environment. Military program with BHZ and Estonia. Constitutionally the responsibility of Governor's in Homeland Defense is important. Slide #17 (Read for oneself). Slide #12 – Read. Slide #s 15, 16, 17, Title 32 – Active Component Title 10, Exercise drill activities, title 32 – National Guardsman has law and order capabilities/responsibilities under State law. Title 32 responsibility unlike regular military, National Guard get title 10 responsibilities as the level of incident increase from large scale hazard to catastrophe (slide 18). Slide 19 – State and Federal Control. Airports are State controlled security by National Guard. Slide 20 – Federal v. Local Response. Task organization (slide 21). Task organization – Federal Reserve Forces together – so that local people can work together. Slide 22 – Read Mission, Slide - 23 (read) – Slide 24 (read) – Slide 25 – Civil Support Team (CST) – Slide #26 – Not fully funded even though MD is in the Capitol region and personnel composition (CST) – civilians bring immense expertise. Slide #27 – Training States (Read). Slide #28 – What can be offered now with State Grant $$ (Read).

Question: What is a heavy CST? It consists of a Civil Support Team (CST) with equipment deployed in 22 states and work with incident commander – state asset belonging to the Governor of that state. Bring together decontamination, communications, interoperability; reach back to many levels of DOD, downward radiological monitoring and other monitoring activities. The most heavily trained CST team is located in PA – take 6 hours to get there. Light CST teams can come sooner and lay ground work. Slide #29 – Read capabilities, Slide 30 – Counter Drug – National Guard overseas this with State Police (high intensity drug trafficking area (some of these assets can be used in Homeland Defense). Slide #31 – Authorized Mission (read). Slide 32-33 – Aircraft C26 in New York, Slide 34 – Internal System – Slide 34 – Imaging available, Slide 36 Missions (read) – Slide 37-40 (view/read). Slide 41 – Guard Response – the Governor has to call out the National Guard – someone has to pay either the requesting agency or the Stare. Civil and contract people must be mobilized first before National Guard. Local assets are available – and should be used before military. Emergency equipment loans – does not require Governor Declaration – but have to know how to pay for operators. There is never pre-commitment of resources – determined by priorities – it depends on situation. Contact information – LTC Jim Grove (slide 42).

Comment and Question. The idea and importance of our LAD Demo is to integrate all these resources.

Ft Gordon

Q: What is CAPWIN?
A: Capitol Wireless Network – a cooperative effort with National Capitol Region Wireless and Wired Communications – JTFMD.com = Joint Task Force under General Jackson – Brand – new JTF – DOD and National Guard Title 10 assets will be brought together.

Q: What kind of interaction with JTF and support?

A: Being handled through North Command through National Guard Bureau – we consider that a Federal Asset – we also provide intelligence to the JTF section from information analysis.

Q: How is Succinylcholine used as asubstrate test in Butyrycholine?

A: It is used as a way to produce an assay level.

The level of symptoms is more important than the level of Cholinesterase if you don't have baseline pre-exposure levels.

Q: If you wanted to predict the future after exposure to organophosphorous compounds?

A: If you only look at the cholinesterase activities, you will not be able to tell. In the Sarin exposure in Japan moderate toxicity = serum values 300-750 IU/L (NL=182-804) – so you cannot tell. Red cell cholinesterase levels ranged 0.3-2.0 IU in patients with symptoms to 1.2-2.0 for those without.

Q: What methods are used clinically and how long does it take?

A: The reference method used clinically is Ellman assay and takes a couple of minutes (Slide # 23)

Comments: That is one of the things the heavy CST brings together in the field.

A: The Test-Mate OP kit is used by the Army and is portable. High performance liquid chromatography (HPLC) is the most accurate, but expensive and time consuming.

Comment: A lot of promising tests out there, but need validation.

Comment: If we can detect a level of cholinesterase activity in a potential organophosphorous (OP) poisoned victim – we would like to make a decision – are we going to keep the victim in or are we going to send them home. If we give t hem an antidote, is that antidote going to last long enough to reverse the OP poison?

Q: How long do the pralidoxine/alvopine antidotes last in relation to a dose of Sarin that might change the cholinesterase level of an individual by say 20-30%?

A: If you wait more than a few minutes, there is a permanently irreversible block of cholinesterase enzyme. No substance will reverse the permanent block.

Comment: So the administration of the antidote is a field 1st responder action.

A: 2 PAM needs to be given within 10 minutes. If you wait, you will have to take them to the hospital. Not much of the enzyme will recover.

Dr. Mackenzie then thanked all of the speakers for their presentations and identified July 8th at 10 a.m. as the next meeting date.

We have two items on the agenda. 1st Fort Gordon will tell us about their resources at the Center for Total Access (mannequins and expertise in planning for demonstrations). Also, their communication with the Eastern U.S. Military channels; 2nd, specific discussion about Campus evacuation planning; and 3rd, possible Rapid Response Teams. Discussion planning

the coordination of their responses.

Dr. Mackenzie commented on a Hicks Association document, Emergency Responders, Needs, Goals and Priorities. He agreed to distribute this document electronically.

Q: Can we do VTC with Ft. Gordon?

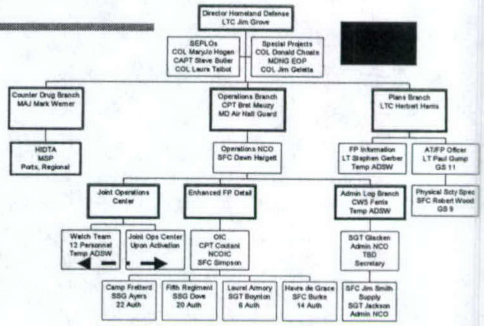
A: Yes. We will see if we – Haddon Matrix material will be written up and sent to you for review.

6/3/04
Meeting

Overview Briefing

Maryland National Guard
Homeland Defense
Military Support to
Civil Authority

Organizational Chart



HLD Office Oversight Responsibilities

- Military Support to Civil Authorities
  - Plans, Policies & Procedures
  - Liaisons to SEOC
  - Mobile Command Post
  - 32nd CST (advise)
- MDNG Joint Operations Center
- Statewide & Regional Communications
  - AM SSB for NGB/FEMA Region III (COOP)
  - FM Repeater Network
  - Mobile Communications Truck

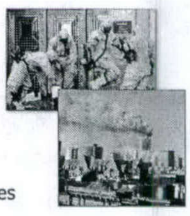
MSCA Oversight Responsibilities

- Anti-Terrorism/Physical Security
  - Policy Management, Administration, and Budget Oversight
  - Cooperative agreement for alarm monitoring, security guards
  - Conduct inspection program in conjunction with PM
  - Oversee AT program for state
- Force Protection Forces at MDNG Key Installations
  - 4 key installations, 81 soldiers
  - Manning of Joint Operations Center and Communications
  - FP Information and Analysis Cell (conjunction with JTTF and 902nd MI)
    - ANG is participants in overall effort

MSCA Oversight Responsibilities

- Military Support Request Program
  - Requests from local community (equipment loans, band, color guard, fly-over, honor guard, etc.)
  - Maintain master database and correspondence program
- Maintain Master Events/Executive Calendar
- Civil Military Innovative Readiness Training Program
  - Past Projects:
    - Wetlands restoration, bridge building, softball fields, Operation Grizzly, Glendenning Park, Greenway Trails, County Fire Training Academy Storm Drain
- Physical Security CCTV Monitoring

AT Program Representation



- Joint Terrorism Task Force
- Anti-Terrorism Task Force
- Maryland Joint Terrorism Network
- Maryland Security Council
- Maryland Terrorism Forum
  - all sub-committees
- Fort Meade and APG AT Committees
- ANG Liaison
- MDNG AT/FP Committee
- Camp Fretterd AT/FP Committee
- Maryland Information and Analysis Center

Current Initiatives & Partnering

Communications Initiatives

- Near Statewide Communications with EMA partnership
- Mobile Interoperable Communications for IAT members
  - state agencies
- Site AM passback
- Java Script GPS Reporting
  - MEMA-NASA Initiative
  - Nextel Platform
- County 800MhZ link
- MSP & ACU 1000
- NGB-State Partnership to showcase standardized communications
  - Guard to Go
  - Ready Guard
  - multi-level standardized reporting
  - all modes of communications
- Anteon Corporation
  - multi-level communications and information reporting system
- CAPWIN & JTF MDW

Current Communications

- National Guard Statewide Repeater
  - rolling code secure radios
- MSP low and high band
- SHA, DNR, FD &PD Mutual Aid, PD Metro, Syscom, Red Cross, Coast Guard, Some Co. FD/PD
- AM SSB (ALE & Email) to EMA, FEMA, NGB
- Mobile Repeaters-two channels (40 watt)
- Sat Phones, Priority Service Cellular, GETS
- Mobile Subscriber Equipment

Other Initiatives

[redacted]

The National Guard Homeland Security Strategy

Constitutional Authorities

The United States is a Union of sovereign States.

To provide for a common defense, we must reinforce the authority and increase the Homeland Security response capability of the Governors of the several states.

National Strategy for Homeland Security

[redacted]

National Strategy for Homeland Security

[redacted]

Local and State Roles

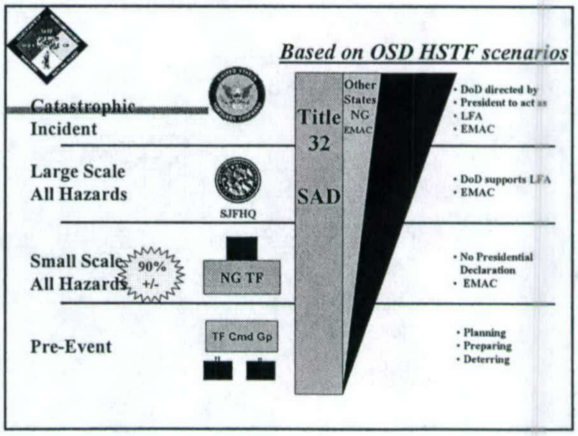
[redacted]

Private Sector Roles

[redacted]

Title 32

[redacted]



Homeland Security
Scorecard Of Federal Requests For Assistance

Federal Control

Civil Support

[redacted]

Homeland Defense

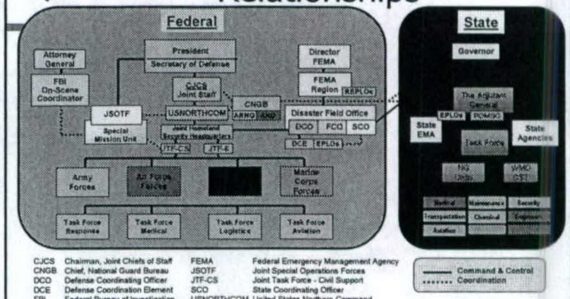
[redacted]

State Control

[redacted]

62 RFAs
48 FEMA, 4 USSS, 3 FBI,
2 FRB, 2 DOI, 1 DHHS, 1 CDC,
1 Congress

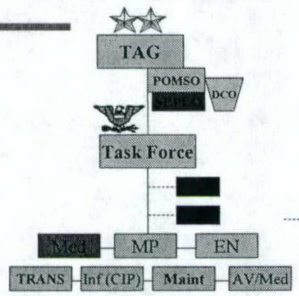
Homeland Security Relationships



CJCS Chairman, Joint Chiefs of Staff
CNGB Chief, National Guard Bureau
DCO Defense Coordinating Officer
DCE Defense Coordination Element
FBI Federal Bureau of Investigation
FCO Federal Coordinating Officer
FEMA Federal Emergency Management Agency
JSOTF Joint Special Operations Forces
JTF-CS Joint Task Force - Civil Support
SCO State Coordinating Officer
USNORTHCOM United States Northern Command

—— Command & Control
.... Coordination

Transformation National Guard
Task Organization

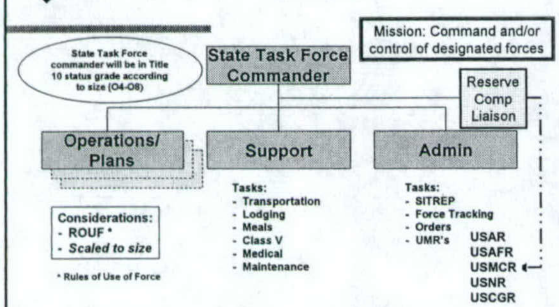


(Capabilities)

Joint State Task Force Mission

[redacted]

State TF for C2 of Federal Forces



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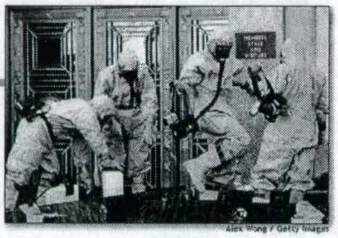
Task Force Functions

[redacted]

[redacted]



MD CST Personnel Composition

[redacted]

Our Status - *Training*

- Members HazMat Technician (MFRI)
  - Allows safe operations on civilian scenes
- Survey Leadership attended Tech Escort Course
- FEMA Radiation Courses
- Emergency Response to Terrorism: HazMat; ERT-Basic; ERT-EMS
- NBC Countermeasures - Ft. McClelland
- Medical Mgmt of Chem./Bio Casualties
- Combat Lifesaver

WHAT WE CAN OFFER NOW!

[redacted]

Capability from DOJ Funds

[redacted]

NG Counterdrug Mission Overview

Authorized Missions

- Linguist
- Intel Analyst
- Communications Support
- Engineer Support
- Marijuana Eradication
- Transportation Support

- **Maintenance / Logistical Support**
- **Cargo / Mail Inspection**
- **LEA Training**
- **Surface / Aerial Reconnaissance**
- **Demand Reduction**

Homeland Security Applications

Specialized Equipment

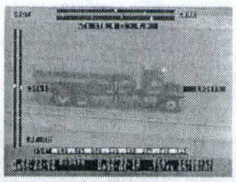
Reconnaissance / Observation

CD C-26

C-26 Mission Equipment

- INTERNAL
  - Situational Awareness Display System (SADS)
    - Controlled from MSO Position (Cockpit Repeater)
    - Integrates Sensor with Street Level Moving Map
    - Depicts Photo Footprint with Cameras On
  - Communications Suite
    - VHF / UHF / HF
    - 29-900MHz Wolfsburg Law Enforcement Radio
    - Air Phone
  - Dual Video Recorders
  - Onboard Print Capability for Digital Imagery
  - GPS Navigational Equipment

Color Spotter Scope



Digital Photography

FLIR

C-26 MISSIONS

- Day TV and Night FLIR Observation
- Photo Reconnaissance
  - Point Target and Mosaic
  - On-board Digital Image Manipulation and Print Capability
- Airborne Command, Control and Communication
- Aerial Transportation

APPLICATION TO HOMELAND SECURITY

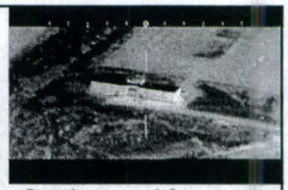
- Can Support Agencies Tasked with Homeland Defense or Security Missions
  - Port of Entry Surveillance and Monitoring
  - Maritime and Border Interdiction
  - Airborne C3 for Major Government, Civil and Cultural Events
  - Emergency Response to National Crisis and Disasters
  - Support to Federal, State and Local Law Enforcement in Offensive and Defensive Operations

Reconnaissance / Observation

CD Reconnaissance and Aerial Interdiction Detachment (RAID)

CD-RAID Mission Equipment

- Thermal Imaging Systems (TIS/FLIR)
- NITE-SUN Search Light
- Night Vision System Capabilities
- High skid gear (unimproved areas)
- Global Wulfsberg LEA Radio
- GPS Navigational Equipment (pinpoint support)



Thermal Imagery System - Can be taped for court
- **Detects heat differences of 1/4 a degree**

NITE-SUN Search Light (30 Million Candle Power)

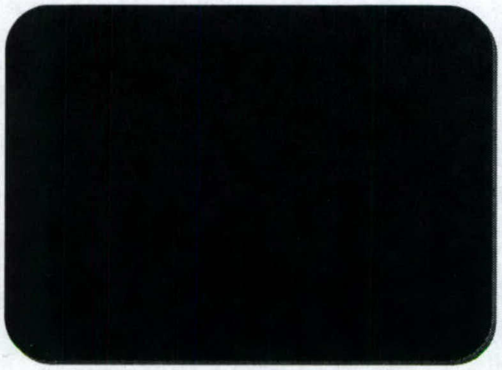
- **Very useful for ground units assisting in apprehensions/unaided areas**
- **Pin-point accuracy on spot locations**

Guard Response

[redacted]

Questions?

[redacted]

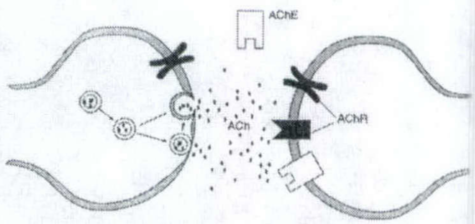


CHOLINESTRASE ASSAY METHODS AND CLINICAL SIGNIFICANT

Nabil A. Anis, D.V.M., Ph.D.
Division of Therapeutic Drugs for Food Animals
Office of New Animal Drug Evaluation
Center for Veterinary Medicine

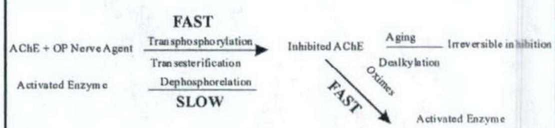
PHYSIOLOGIC ACTION OF CHOLINESTRASE

The major action of cholinesterase (ChE) is to terminate the action of acetylcholine (Ach) at cholinergic nerve endings in synapse or in effector organs



ACUTE TOXICITY OF ORGANOPHOSPHATE (OP) NERVE AGENTS

Acute toxicity of organophosphate nerve agent is due to excessive accumulation of acetylcholine at the muscarinic and nicotinic sites



VARIOUS NAMES FOR CHOLINESTRASES (ChE)

Acetylcholinesterase (AChE)	Butyryl cholinesterase (BChE)
Acetylcholine acetyl-hydrolase	Benzoyl acylcholine acyl-hydrolase
EC 3.1.1.7	BC 3.1.1.8
True	Pseudo-cholinesterase
specific	Nonspecific
Genuine	False
Type 1 ChE	Type II ChE
Erythrocyte ChE	Plasma, serum ChE

DIFFERENCES BETWEEN ACHE AND BCHE

ENZYME	AChE	BChE
Heterogeneity	One enzyme, may be a variant	Many enzymes & isoenzymes
MW	80,000 Daltons (Monomer)	340,000 Daltons (Tetramer held together by disulfide bonds)
Natural Substrates	Acetylcholine, Methacholine	Fatty Acyl esters & Aromatic esters
Test Substrates	Acetylcholine, Methacholine	Acetylcholine, Butyrylcholine, Benzoyl choline & Succinylcholine

DIFFERENCES BETWEEN ACHE AND BCHE, Cont.

ENZYME	AChE	BChE
Substrate Kinetics	Acetylcholine > propionylcholine > very low rate for butyrylcholine	Butyrylcholine> propionylcholine> low rate for acetylcholine
Assay Advantages	Better reflection of synaptic inhibition	Easier to assay, declines faster
Use of assay	Acute exposure, Response to treatment, Unsuspected prior exposure	Acute Exposure

NORMAL CHOLIESTERASE LEVELS

- Many assays are employed and not all measurements are inter-convertible
- Best to express the results as a percentage of the normal
- Cholinesterase levels of normal unexposed individuals varies between 4000 and 12,000 IU/L at 37°C
- Individual esterase levels are fairly constant

NORMAL CHOLIESTERASE LEVELS

- Neonatal levels are initially low, reaching adult levels after 2 months of live.
- Women have lower BChE levels than men.
- ChE levels of red cells is not gender-specific.
- Racial differences in the AChEs levels have been observed.

CHANGES IN LEVELS OF BChE ASSOCIATED WITH PATHOLOGIC CONDITIONS

Decreased Levels

- Liver insufficiency
- Acute infection
- Pregnancy
- Pulmonary embolism
- Muscular dystrophy
- Myocardial infarction
- After surgery

Increased Levels

- Nephrotic Syndrome
- Thyrotoxicosis
- Hemochomatosis
- Anxiety
- Other psychiatric conditions

FALSE DEPRESSION OF AChE AND BChE

Acetylcholine (AChE)

- Pernicious anemia
- Hemoglorinopthies
- Antimicrobial treatment

Butyrylchoine (BChE)

- Liver dysfunction, Malnutrition,
- Hypersensitivity reactions
- Drugs (succinylcholine, codeine, morphine)
- Pregnancy, Genetic deficiency

CLINICAL INTERPRETATION

- In acute poisoning, BChE levels fall more rapidly than AChE.
- In moderate to severe poisoning both levels fall; hence a total blood assay can be used.
- Mild poisoning occurs when ChE activity is 20 to 50% of normal.
- Moderate poisoning occurs when the activity of the enzyme is 10 to 20% of normal
- Severe poisoning occurs when activity is under 10%.

CLINICAL INTERPRETATION

- Severe neuromuscular effects are usually seen when BChE levels drop to below 20% of normal
- Levels near zero can be fatal and require emergency treatment.
- However, total inhibition of BChE and 60 to 70% inhibition of RBC ChE activity has been noted in the absence of overt signs of poisoning

CLINICAL INTERPRETATION

- Enzyme inhibition may be loosely correlated with clinical signs and symptoms.
- Because of high variability between individuals, only comparison between a base levels before and just after exposure is meaningful.
- Exposure history, symptoms, and clinical findings are more significant than ChE levels.

EXAMPLE OF LEVELS OF ChE AND CLINICAL SIGNIFICANT

- In Japan 66 victims were exposed to Sarin.
- patients with moderate toxicity had a serum values of 300 to 750 IU/L (normal values = 182 to 804).
- These patients had red blood cell ChE (AChE) activity ranging between 0.3 and 2.0 IU (compared to 1.2 to 2.0 for patients not showing symptoms).

ASSAY PRINCIPLS

- The most significant physiologic action of ChEs is the hydrolysis of Ach to choline and acetate.

  Acetylcholine $\longrightarrow$ Choline + Acetic Acid
- The assay may measure:
- The chemical entity (Sarin), or
- The reaction:
  - Reduction of a substrate and/or
  - Formation of a product

ASSAY METHODS

(A) Classic

(B) Electrometry

(C) Spectroscopy

(D) Chromatography and

(E) Miscellaneous Tests

CLASSIC ChE ASSAYS

- Biologic Assays: the physiologic function of ACh is measured (e.g., effect on perfused heart).
- Titrimetric Assays: a pH indicator solution and known concentration of alkaline solution is used to measure the amount of acetic acid.
- Manometric Assays: the rate (pH/Hr) of production of CO2 released from hydrolysis of ACh is measured.

Electrometry

This method measures the rate of acid production from the hydrolysis of ACh and quantitates it in units of rate change of pH/Hr

SPECTROPHOTOMETRIC METHODS

- These are colorimetric assays in which ACh or its metabolites are coupled to color reagents.
- The formation or disappearance of color is measured at specific wavelengths.
- The Ellman assay is the reference method used clinically.

ELLMAN'S ASSAY

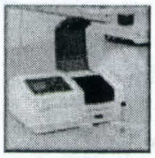
- This method utilizes acetylthiocholine as substrate and 5,5-dithiobis-2-nitrobenzoic acid (DTNB) as the color reagent according to the following reaction.

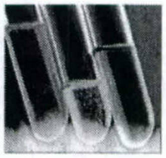
1. Acetylthiocholine + ChE $\longrightarrow$ acetate + thiocholine (Colorless)
2. Thiocholine + DTNB $\longrightarrow$ TNB (Yellow)

- TNB has maximal absorbance at of 412 nm

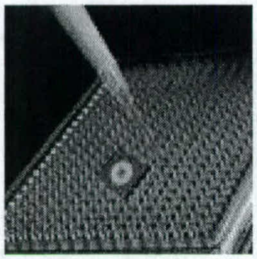
DTNB = 5-5'-dithiobis-2-nitrobezoic acid
TNB = 5-thio-2thionitrobenzoic acid

EQUIPMENT

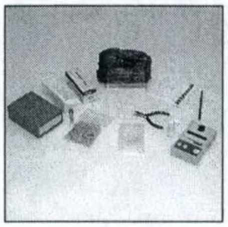




ALTERNATIVE EQUIPMENT



TEST- MATE OP KIT EQM RESEARCH



CHROMATOGRAPHY

- Detection of intact organophosphate compounds in blood is possible only during or soon after exposure, due to the rapid hydrolysis of these compounds.
- High-performance liquid, gas and thin layer chromatography can be used for identification of the Anti-ChE parent compounds and metabolites
- These procedures are expensive, time consuming and not used routinely in clinical laboratories.

Miscellaneous Tests

- Radiometric
- Fluorescent methods
- ACh selective electrode
- ELISA test kit
- Ultraviolet Spectrophotometric methods
- Gasometrical methods
- Chemiluminescence.
- Sensors for direct detection of OP nerve agents are available, but are very expensive and the reliability of such sensors has not been tested

EXAMPLES OF MONITORING EQUIPMENT

- M-8 paper
- M-9 paper
- M-18A2 detection kit
- M-256A1 detection kit
- M-272 water test kit
- CAM chemical monitor
- ICAD chemical agent monitor
- M-90 D1A chemical agent detector

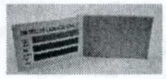
EXAMPLES OF MONITORING EQUIPMENT

- M-8A1 Alarm
- MM-1 mobile mass spectrometry gas chromatography
- SAW Mini-CAD
- ACADA
- Field Mini-CAMs
- Viking Spectratrak GC/MS
  HP flame photometric detector

M-8 and M-9 Papers

- Inexpensive (5 dollars per run)
- Easy to use, fast (30 seconds)
- Use only 10 µl drops
- Papers have long shelf life
- Detect Nerve-G, VX, Mustard-H
- Works on liquid only
- Measures pH of compounds
- Large potential for false positive

M-8 and M-9 Papers



M-256A1 DETECTION KIT

- Relatively inexpensive ($ 240)
- Easy to use, slow (15 min)
- Detect Nerve GB, VX, Mustard H, HN, HD, HT, Lewisite-L, ED, MD, Phosgene-CG
- Use vapor and liquid
- Measure chemical reaction for nerve agents (Ellman)
- Kit has long shelf life
- Reasonably sensitive

M-256A1 DETECTION KIT

VIKING SPECTRATRK GC/MS

- integrated portable gas chromatograph/mass spectrometer (GC/MS)
- Compact, and robust, but heavy (85 lb.)
- Detects Nerve-G, V, and many other chemicals
- Expensive (100,000) and slow
- Needs trained personnel to operate
- Needs 120 V AC
- Gives laboratory quality analysis
- Highly specific and sensitive

VIKING SPECTRATRK GC/MS

Local Area Biodefense/Surveillance Meeting Notes
July 8, 2003
10 a.m. – 12 noon
National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

Baltimore City Medical Society and UM Specialty Hospitals
James Flynn, MD, Vice President (jflynn@umm.edu)
Center for Total Access, Ft. Gordon, Georgia (via teleconference)
COL Warren Whitlock, MD, Director (warren.whitlock@se.amedd.army.mil)
LTC Richard Moore, MD, MPH, 3rd Medical Command Liaison to CTA (richard.h.moore@se.amedd.army.mil)
Gay Thompson, RN, MPH, Nurse Coordinator (gay.thompson@se.amedd.army.mil)
Dyncorp/DTRA (Defense Threat Reduction Agency)
Jerry Stockton (jerry.stockton@dyncorp.com)
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John Magness (john.magness@med.va.gov)

Dr. Mackenzie welcomed all the attendees and those teleconferencing from Fort Gordon's Center for Total Access, GA (see cover page). Colonel Whitlock began his presentation (slides are Attachment 1) by expressing his interest in this collaboration between the Center for Total Access at Fort Gordon and the NSC. These presentations will identify some epidemiological issues related to medical situational awareness that were published in Science (see last slide of Colonel Whitlock's presentation for references on transmission dynamics of SARS) in collaboration with Dr. Huberchak. These slides represent the direction of medical research. The consequence management highlights (Slide 2) of the demonstration will be an exercise of RAMSAFE for a simulated SARS scenario. The Science papers are the first published in-depth analysis of the SARS epidemic. The analysis identifies the "Super Spreader" event.

The exercise will use military personnel, with client servers, within the public health arena, CDC and FEMA Region IV HQ. Part of this is a joint service installation pilot program (JSIPP) in which equipment provided by Fort Gordon will be available for review. The National Response Plan is replacing the Federal Response Plan. The changes merge crisis management to include an all-hazards approach – Basic and Advanced Disaster Life Support. These will provide a flexible approach to all hazards. A Senior Leadership symposium will be part of the effort to get collaboration and new partnerships to get an after-analysis of the exercise results to plan the FY04 and FY05 consequence management exercises – allows us to develop the training requirements of interoperability.

Slide #3 includes one of the references talking about transmission. There were two large super spreader events in the SARS epidemic—individuals spread to up to 300 cases per day. The average for secondary infection was 2.7 infections per day. Once control measures were instituted these could be controlled. One of the high points is focusing on the super spreader event – SARS is highly transmittable, potential for global dissemination. So this model is the focus for homeland security and also public health (Slide 4). This shows how the spread occurred within China. The graphs show how the individual areas were responsible for spread within the initial ten days. The native level of resistance can be measured and defined by serology testing to determine our risk for a new crisis (Slide 5) show the spread diagram with our consequence management scenario. Five groups of three people intentionally spread SARS across the SE by flying into Atlanta International Airport (largest in the US). All five groups are simulated super spreaders who understand what they are doing, so they can infect many more than 3,000 people per day. These virus terrorists carry the virus that is otherwise difficult to transport. This is a stochastic model (Slide 6) of transmission. Once China instituted measures to restrict travel and identify carriers, they began to get SARS under control. The intentional super spreader is by definition a biological warfare event. Smallpox does not have nearly the risk of a super spreader event. Future discussions and planning for disaster response must include "super spreader terminology" for effective planning.

This stochastic model has been built using the actual number of cases of SARS that occurred in China and this allows us to look at the transmission co-efficient, -- e.g., for TB, it's very low – for TB you need prolonged interaction, whereas SARS is as

transmissible as the common cold. This model also takes into consideration the geographic susceptibility of the population.

Older people are more susceptible to infection (Slide 7). How SARS epidemiology affects Homeland Security is that, although it has not been accepted by CDC as a biological agent, clearly each naturally-occurring infectious agent is a naturally-occurring biologic agent in the right circumstances. Using the super spreader approach is part of the biological agent consideration. Reducing the ramification rate over time is the public health goal. The biggest factor affecting replication times are super spreaders. Testing of and breakdowns in interoperability across local, sate and federal systems was one of the weaknesses in China. Improvement in this is needed for new National Disaster Medical Systems plan (Slide 8) SARS spread all across the world – in our scenario, the mortality is only 1,500; however, it has 60% of people hospitalized due to the severe nature of respiratory infection. Right now our hospitals do not have the surge capability. It is probably up to federal agencies like the VA that must come up with an interface with the state to provide that kind of system (Slide 9). Utilizing RAMSAFE, the goals are shown on the right side of Slide 9.

Slide #10 The AMA and HHS are supporting a new disaster training curriculum that will enable a "coordinated response to every emergency disease" (Jerome Hauer—Office of Public Health Emergency Preparedness of HHS). We need that seamless interface between local, public health, country, state and regional public health to CDC. Making this happen will be critical to control these sorts of infections (Slide 11) FEMA Region IV will exercise regional responders and the CMX is a joint city, state, federal/DOD effort to identify shortfalls and improvements in system response as well as new technology solutions. Southeast Region Medical Command has authority over army hospitals in four of the eight states of FEMA Region IV.

Slide 12 Colonel Whitlock highly recommends the references in the June 20, 2003 issue of Science. National Disaster Institute Medical System will build on top of what is already in place. We need to exercise some of the hospital systems interfaces with scenarios like the one we will be testing that activate all pieces of the emergency response. It will draw attention to how we are going to develop the hospital beds and medical personnel and training.

Q: The National Response Plan (NRP) that is replacing the Federal Response Plan (FRP) does it still have the shape of an interagency agreement as FRP was that was activated under Robert B Stafford act. They would supply resources necessary. Also is it set up with the 12 emergency response functions?

A: NRP is not as specific as in FRP, but it appears more powerful. It calls on all federal state and local agencies concerned with Disaster Prep and Response to participate. If opens the door for a lot of collaboration over last three years Dept of Justice (DOJ) has to improve understanding of consequence management, rather than crisis management. DOJ has a lot of research dollars for management but we need to merge crisis with consequence management and have all agencies integrate their capabilities. The

guidelines or the FCC 106 (June 23, 2003) are very specific and requires federal centers as Eisenhower is the only DOD facility capable in SE U.S. with the largest expandable bed capacity. We have a series of civilian hospitals in our system that we could utilize in a disaster. There are very few requirements in the guidelines for you to interact or train with the agencies.

Q: Surge capacity- any solutions?

A: One essential element for effective medical surge is for our leaders to realize is that the bulk of expandable hospitals in this country are military and VA. Otherwise, the whole concept behind JSIPP is invalid. We need to take real episodes like SARS that could happen in this country and to include the necessary interoperability response in our training. The crisis and consequence management needs to consider the surge capability within the hospital structure using many volunteer participants in every state – needs to be supported by federal systems.

Q: For our exercise we are interested in the mannequins you have at CTA. How do you use these in exercises?

A: Until we start moving people we don't realize how difficult they are to move and fit into ambulances. When you run through a training scenario, you can let the students carry out invasive medical procedures during the exercise. Also, we can use communication tools such as RAMSAFE or ADASHI . You can simulate medical situations better for scenario and team training. Currently these mannequins are part of the Basic Disaster Life Support (BDLS) and Advanced Life Support (ADLS) training endorsed by the AMA for medical disaster curriculum last month.

Q: The super spreaders - were there any epidemiological characteristics of those individuals?

A: The one slide about the contacts shows that these are unique individuals that just happened to be in contact and environment to rapidly spread the infection. (These were accidental, but clearly intentional spread could be far more serious).

END

Robert Rowan (slides are Attachment # 2) Campus evacuation is part of the Emergency Management Plan. The campus is about 36 acres, 50 campus buildings and 10-15,000 people representing a small piece of Baltimore City (Slide 1). How did the evacuation plan come about? – with duct tape and polyethylene! When the Department of HHS made their recommendation for sheltering in place, we developed a shelter-in-place plan and identified building coordinators to be responsible for each building. In training coordinators suggested leaving and this triggered the evacuation plan as a corollary to the shelter-in-place plan. The shelter-in-place plan is a short-term solution (hours) – no plans to stockpile to keep people for days.

If we look at different hazards, some might call for shelter-in-place – others for evacuation (Slide 2). Goals for evacuation are same as for emergency management plan to protect population and allow quick recovery and reduce risk exposure. Healthcare, research and community service is our mission – it is important to plan and expedite decision-making and implementation of action to reduce risk (Slide 3).

Campus evacuation uses incident command model (federal). Primary response unit for campus evacuation is the Office of Public Safety. Parking and the Office of External Affairs – media contact -- are secondary response units. Most evacuation scenarios, outside agencies will be involved, including Baltimore City Police and Maryland National Guard or FEMA or MEMA. At some point in the process they would assure the incident command role – we would take direction from them (Slide 4).

Triggers for campus evacuation include weather, fire civil disturbance, airborne or infectious hazards or a directive. A lot of reasons to evacuate campus, however, the Emergency Management Team needs time, identification of toxicity, probability of impact on campus – is evacuation a realistic option with only a few minutes warning. Is the toxicity an annoyance (e.g., smoke) but not dangerous? The campus problem is maintenance of essential services – large number of faculty provides essential service to the hospital, clinics and VAMC. Should they be evacuated or stay on campus? It's a difficult decision and not clear when it should be made. (Slide 5).

Evacuation is not the only option – could be used in conjunction with shelter-in-place. Need information to make best decisions, .e.g., traffic may be so heavy so as to make stay-in-place better. Eighty percent of the campus drives to work. We need to look at carpool – walking – may be a good alternative to get out of danger zone – if we have the information about the threat (Slide 6). Information and communication to and from the Emergency Management Team and to the members of the campus are key to successful plan. Traffic information critical, threat information, the speed it will arrive, the area that will be impacted – all need to be known. Will the person be safe five blocks away or five miles away – this could be critical for decisions made about what to tell people to do. Walking may be best if only a few blocks. Alternatively, shelter-in-place could be better than evacuation (Slide 7). How is this information disseminated to 10-15,000 people on campus? We use existing chains of communication with individuals directly to faculty, students and staff (Slide 8).

We use building fire wardens -- over four hundred on campus – two for every floor -- can be contacted with e-mail, web and auto dialed to call them up. Sixty building coordinators – they will be added to distribution list. They can spread the word to their people. Web page Campus Alert on left hand corner – can put information on recommendations about traffic evacuation. Parking garages will have bulletin boards at exits to give direction about evacuation routes, blocked roads etc. (Slide 9) Other Issues: still working on second and third shift employees communication on days are often not effective on other shifts, e.g., housekeepers/students. Building coordinators on second and third shifts will also be trained. Several hundred students live on or around campus. No established communication links with them. We need strategies to communicate with

them. If they do evacuate, where do we house these people who may live on campus. We are talking to counterparts at UMBC housing –reciprocal arrangement. The patients are vital -- who is going to care for them?– can we evacuate them? – what happens to hospital? Police etc. - very tough question – need accurate information to assess threat – difficult decision. Part of campus evacuation plan is on the web site (Slide 10). City evacuation- snow emergency route -- not necessary helpful. Best info is available from MDOT CHART program. Traffic Alert page with cameras on main arteries and intersections -- these can be very helpful on web (Slide 11).

Q#1) How will we deal with bottlenecks getting out of campus garages?

Q#2) How do we notify people not to come to work?

A: We can use the Web – Don't come in – there is also an emergency phone number, 706-UMAB number that you will hear if campus is closed – this has to be done before they leave the house. Traffic exit is a problem – we talked about staggering when people could leave – very hard to control, especially in a crisis situation.

Suggestion: put an emergency pop-up on the Website.

A: We are looking at this now – OEA office it trying to put in a pop-up or bell.

Q: Can we use the media as a source to inform campus?

A: Our OEA office is part of the secondary response – people look at TV first in a crisis situation – up-to-date – more current, but not always accurate.

Comment: MIEMSS is working with campus Emergency Management Plan. Evacuation plan is very difficult to implement as would be shelter-in-place. (tape end here)

Next speakers were introduced. Jim Genovese of SBCCOM and Alex Menkes for Optimetrics. Jim Genovese was introduced by Mr. Alex Menkes as an international expert on counterterrorism for past ten years and he has provided incident response to numerous government agencies. Currently technical consultant to the director of the Edgewood Chemical and Biological Center for WMD, he is the inventor of ADASHI. Alex Menkes is a software developer and program manager for ADASHI at Optimetrics, which has licensed it from Edgewood.

Jim Genovese has worked for 22 years with the Army ; it is exciting to see the collaboration and lack of "stove piping," but working together as a team (Slides are Attachment #3). Background on ADASHI (Slide 1) came about as a result of teaching about counter-terrorism in 120 cities about chem-bio-rad emergency response including hazmat. ADASHI is helpful for integration because we teach modules, hazard assessment of investigation –rather than interdependency of all aspects of emergency response – all are interrelated especially in a real incident where they may occur simultaneously. Subtle chronology occurs as well as obvious chronology. These subtleties are not necessarily

apparent to incident commanders. So ADASHI is an intelligent system that would help practical units as well as incident commanders to look over their shoulders and make better decisions – looking, for a 30% improvement in decision making – where data was previously impossible to track or was coming in so fast that they cannot manage it. Track these events and decisions and provide status and make predictions of outcomes that would be useful for planning for the incident commander (Slide 2)

ADASHI is a logical, user-friendly system for tracking and communicating with incident commanders. Different approaches to some problems are acceptable – logically to reduce hazard, lowering the dosage of hazard to unprotected people. ADASHI "nudges" you in the right decision-making direction. A 30% improvement results in efficiency and reduction of crisis and consequences and number of affected people (Slide 3). Characteristics, user-friendly, automated information distribution – has provision for expertise sources access. Automated tracking hazards and their effects is difficult. Indoor modeling of hazards. ADASHI provides information on garments to be worn and characteristics of hazards – knowing more about hazards. Sensor integration and fusion – we do not know how to fuse the sensor information. Data sensor fusion is needed and we now have the processing and fuzzy logic to do it – this can help decision-making. The tracking tells you what is happening in the environment – looking at dose received so as to calculate minimal, immediate, expectant, delayed even psychogenic casualties (Slide 4). The problems and questions are many. How many decon stations, how long will gear protect etc.?

Q: Any attempt to calculate psychogenic casualties?

A: A lot of low-level casualties, e.g., tunnel vision in Tokyo after Sarin – many others decided they had symptoms.

Q: Anything in software inform decisions for psychogenic casualties? When and how to communicate information?

A: Right now no, but you could add this to casualty distribution.

Comment: How and when you provide information – what you say and when you say it can affect the outcome.

A: An add-on piece of signs and symptoms – this could be added – input without sensors – observations. ADASHI will be available in the field as well as a "call-in" version.

Q: A lot of tests we use to assess patients – could these be used to develop standard of practice for assessment?

A: We do give guidance on human signs and symptoms. We can help you assess what the agent could be. We can also assess dosage to some degree. We provide levels of confidence of what ADASHI thinks it is – it provides information on sensors needed for confirmations.

(Slide 5) ADASHI key response functions – shows interdependencies and logical connections and linkages (Slide 6) Processing depends on input and provides output. What do they want to see as status and actionable information – what options are available – what can we do next?

Alex Menkes now presented (Slide 7). His job was to turn the ideas into software. Many parts to ADASHI: Hazmat, EMT version, fire and police version, operation center version. Each of these units is intended to be stand-alone. They do not depend on networks. First Response is done. Professional is under development, Enterprise will follow in six months. (Slide 8) First Response. Simple interface – a street-level map page to assess incident – has tools to help. Q&A options – liquid/solid/gas etc. Gives best guidance possible – customized checklists -- plume analyses – ALOHA used (but takes quite a lot of time and training). Goal of ADASHI – should be usable without training – uses ALOHA as background. Meteorological acquisition – FEMA reports are generated. (Slide 9) of ADASHI Professional – based on Jim Genovese plan – does visual inventory, protective equipment and will include pharmaceuticals. Resource teams and help with deployment and training scenarios. There is a situation awareness display for command and control. It will give course of action recommendations.

There is hazard integration in ADASHI software – we have medical support; we can identify hot zone/warm zone plume. This is integrated with advice on the appropriate equipment to wear – how long wearing this equipment you may be safe in this environment (Slide 10) This is the PDA version of ADASHI – can be operated with a gloved hand (Slide 11). This is one of the components – can be built to include access to other programs or allow ADASHI to be integrated into other pieces of software. The interface is easy to operate even in Class A protective gear. The PDA version has a camera on it to all patient ID by taking a picture (Slide 12). Call center version – intensity and onset time for each observed sign and complained-about symptom.

The advantage of this is that the same format might be useful for trauma to facilitate diagnosis and triage by sending the data back remotely.

Q: Are people using this?

A: We are working with Baltimore City. The First Responder version has been deployed – We are still working on the Professional version.

Q: How do you acquire the weather info in real-time?

A: Two ways. First is through a portable device, the second through the Internet.

Q: Could you make a medical decision for treatment based on ADASHI information?

A: At this time no, but it would give you enough information about what the agent is. Right now we do not provide that level of treatment support. It is a goal of ours – we are working to integrate the medical procedures as part of this guidance.

Q: I am interested from the Special Forces Medical Knowledge – we need a standardized lexicon of symptoms and signs. We are interested in medical decision support and I wonder whether you have pre-market approvals in place?

A: We have not submitted an FDA application, but that is something we would be very pleased to do. The software does meet all of the FDA standards. If we include medical info.

Comment: If there is an opportunity to do this, we would like to talk more about it.

Colin Mackenzie then presented some slides starting by commenting that he was at the NIH Information Infrastructure (NIHII) meeting for Homeland Security last week. There was nothing particularly novel about what was being suggested – of a 10,000 foot view of what needed to be done regarding interoperability of the infrastructure. The CDC is going to be brought more directly into the picture.

A model of Sarin dissemination using ALOHA was demonstrated. Some slides of the effect of weather conditions, Sarin concentrations and differing wind velocities and temperatures were shown. The ALOHA software allows identification of "safe havens" with knowledge of wind direction and velocity. A northwest wind would impact the Inner Harbor. More westerly winds the financial district of downtown Baltimore if released on UM campus. A southerly breeze would impact the downtown Social Security complex (Attachment #4 is Dr. Mackenzie's slides.)

The meeting was concluded by outlining the future plans as follows: 1) There will be no meeting of LAD Demo planning in August –rather, small groups will discuss campus evacuation and rapid response teams and report back to the main meeting in September. 2) Meetings with sensor companies will be taking place and some suggestion on deployment will be discussed. 3) The planning/MOA's and integration with the Emergency Management chain of command will continue.

Dr. Mackenzie thanked Colonel Whitlock and colleagues at the Center for Total Access, Ft. Gordon, GA and all the presenters and attendees. The minutes will be distributed electronically.

7/8/03 Meeting

Automated Decision-Aid System for Hazardous Incidents (ADASHI)

James A. Genovese
Edgewood Chemical Biological Center

Alex Menkes
OptiMetrics, Inc.

U.S. Army
Soldier and Biological Chemical Command

System Focus

Edgewood Chemical Biological Center

- To Enhance Timely Tactical Decision Making of Operational Responders in Life-Threatening Hazardous Incidents
- Allows for Multiple Scenario-Dependent Options —NOT SCHOOL BOOK SOLUTIONS

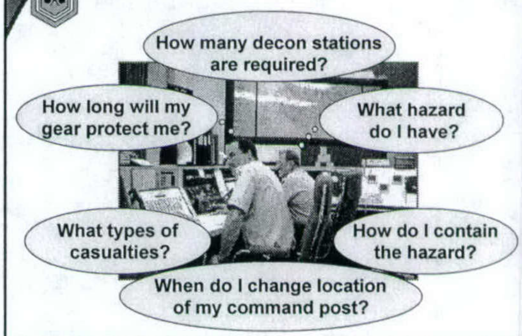
Characteristics and Features

Edgewood Chemical Biological Center

- User-Friendly Input/Output Displays
- Automated Information Distribution and Receipt (Tracking Tool)
- Embedded Hazard Prediction Models
- GIS Mapping
- Hazard Assessment Module
- Sensor Integration and Fusion

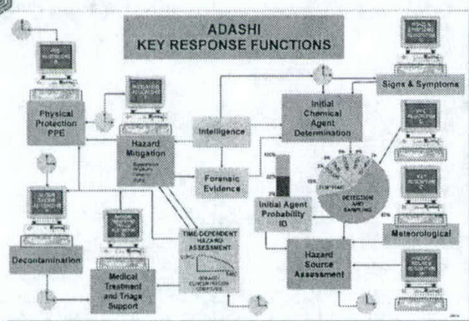
Many Tactical Questions Need Answering

Edgewood Chemical Biological Center



Immediate Actions in Multiple Areas - Required

Edgewood Chemical Biological Center



Process

Edgewood Chemical Biological Center

Situation Awareness ➔ Operations and Hazard Assessment ➔ Response Actions and Options

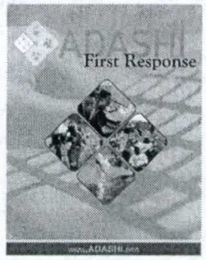
(Input) *(Processing)* *(Output)*

ADASHI Product Line
Edgewood Chemical Biological Center

ADASHI

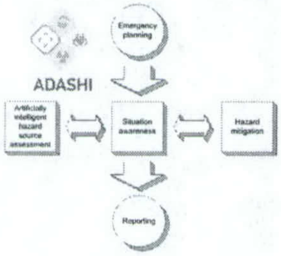
- ADASHI First Response
- ADASHI Professional
- ADASHI Enterprise
- ADASHI Components

ADASHI First Response
Edgewood Chemical Biological Center

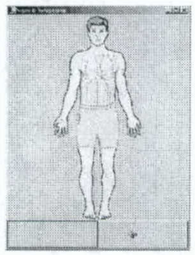


- Sophisticated interface.
- Tracking and reporting.
- Customizable checklists.
- Street level OCC.
- Agent identification aids.
- Identified agent reports.
- Operation guidance.
- Meteorological acquisition.
- Hazard region identification.

ADASHI Professional
Edgewood Chemical Biological Center

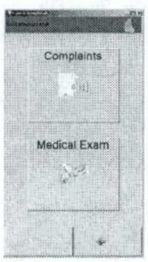


ADASHI Components
Edgewood Chemical Biological Center

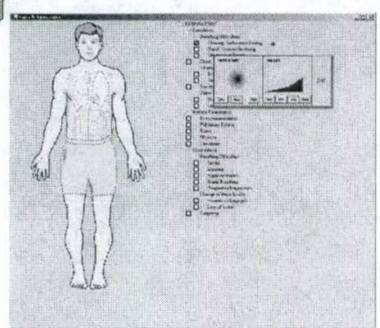


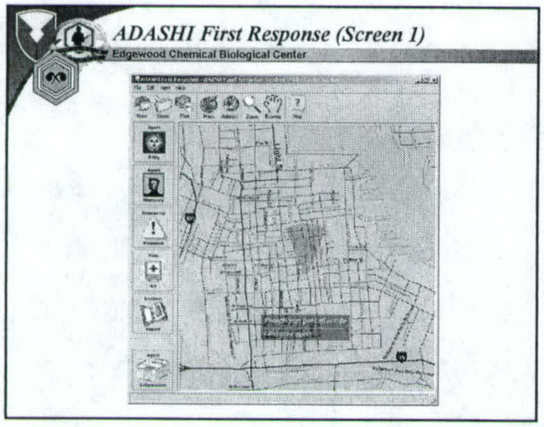
- Signs & Symptoms
- Physical Protection Equipment Module
- Detector Inventory and Deployment

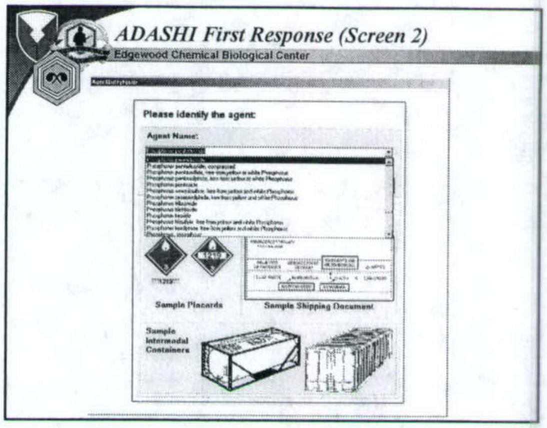
Signs & Symptoms (PDA)
Edgewood Chemical Biological Center

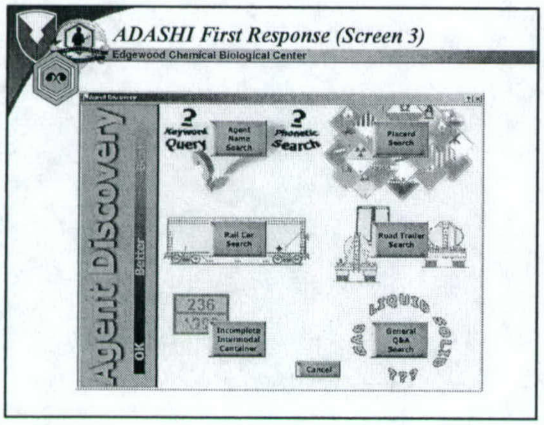


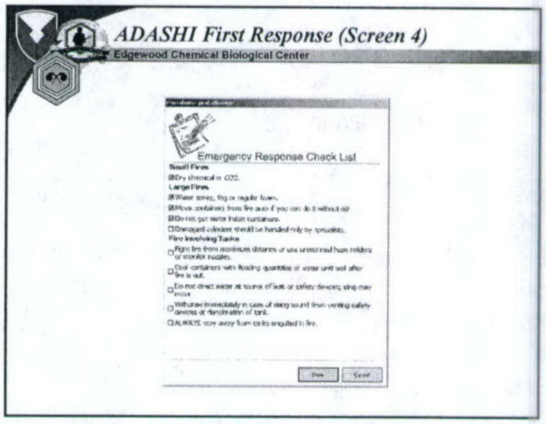
Signs & Symptoms (Call Center)
Edgewood Chemical Biological Center

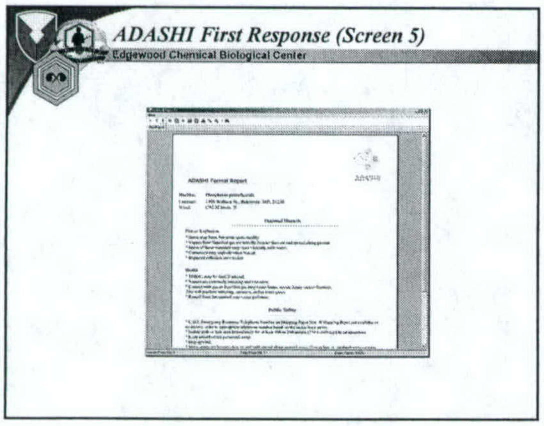


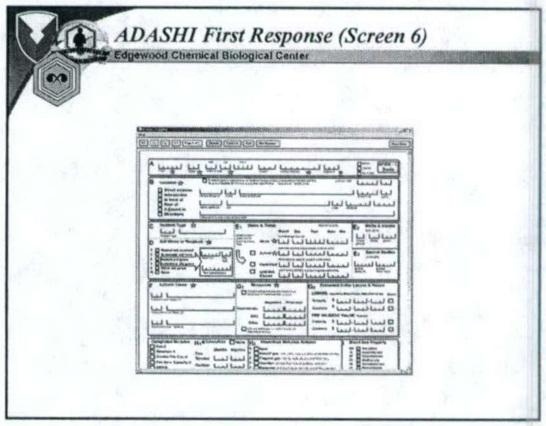

ADASHI First Response (Screen 1)
Edgewood Chemical Biological Center


ADASHI First Response (Screen 2)
Edgewood Chemical Biological Center
Please identify the agent:
Agent Name:
Sample Placards
Sample Shipping Document
Sample Intermodal Containers

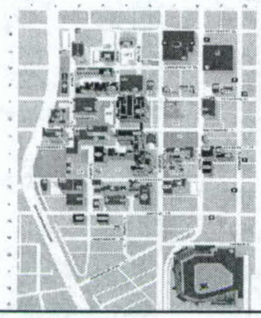

ADASHI First Response (Screen 3)
Edgewood Chemical Biological Center
Agent Discovery
OK
Better
Keyword Query
Agent Name Search
Phonetic Search
Placard Search
Rail Car Search
Road Trailer Search
Incomplete Intermodal Container
General Q&A Search
Cancel


ADASHI First Response (Screen 4)
Edgewood Chemical Biological Center
Emergency Response Check List
Small Fires
Large Fires
Fire Involving Tanks


ADASHI First Response (Screen 5)
Edgewood Chemical Biological Center


ADASHI First Response (Screen 6)
Edgewood Chemical Biological Center

Campus Evacuation plan



Campus Evacuation Plan

- Part of the Emergency Management Plan
  - Origins
    - Duct tape and polyethylene
    - Shelter in Place Plan
    - Building Coordinator Training

Campus Evacuation Plan

- Goals
  - Protect employees, students and visitors
  - Recover quickly from disruptions
  - Reduce our risk exposure

Campus Evacuation Plan

- Incident Command model
- Public Safety is the Primary Response Unit
- Parking and OEA are Secondary Response Units
- Baltimore City Police

Campus Evacuation Plan

- Triggers-
  - Weather
  - Fire
  - Civil disturbance
  - Air borne hazards
  - Infectious agents
  - Government directive

Campus Evacuation Plan

- Emergency Management Team needs information
  - Lead time
  - Toxicity
  - Probability of impact on campus
  - Essential Services

Campus Evacuation Plan

- Evacuation
  - In conjunction with Shelter in Place
  - Traffic dependant
  - Alternatives
  - Early warning

Campus Evacuation Plan

- Communications is key
  - Traffic information
  - Direction of threat
  - Alternate strategies

Campus Evacuation plan

- Communication Strategies
  - Use existing chains
  - Fire Wardens and Building Coordinators
  - Web
  - Parking garage exit signs

Campus Evacuation plan

- Other issues
  - Second and third shift employees
  - Student residents
  - Alternate housing
  - Patients
  - Essential employees

Campus Evacuation Plan

- Information
  - City Evacuation Routes
    - http://www.ci.baltimore.md.us/news/press/020702
  - MDOT traffic alerts and cameras
    - http://www.chart.state.md.us/

Campus Evacuation Plan

- Questions?

CONSEQUENCE MANAGEMENT 2003

Consequence Management Exercise (CMX) Scenario Planning for 2003

"Local Area Biodefense/Surveillance Meeting (LAD)" &
the "National Study Center for Trauma & EMS"
Baltimore, Maryland,

8 July 2003

* Warren L. Whitlock, M.D., COL, MC
&
** David Huburchak, M.D., (COL, MC, retired)

* Director, Center for Total Access
Southeast Region Medical Command
Fort Gordon, Georgia

** Department of Infectious Disease
Medical College of Georgia
Augusta, Georgia

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CONSEQUENCE MANAGEMENT 2003

CMX03 Highlights

- Demonstration-exercise of RAMSAFE™, using the Army Medical Command's designated application for Homeland Security showing activation of the National Disaster Medical System NDMS for a *Severe Acute Respiratory Syndrome (SARS)* Scenario.
- JSIPP (Joint Service Installation Pilot Program) sponsored equipment and technology provided to Fort Gordon will be available for review. As part of the JSIPP mission, time during the CMX will be dedicated toward Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) response training.
- An ALL HAZARDS medical response curriculum will be provided through a series of didactic classroom presentations, known as *Basic Disaster Life Support (BDLS)* and a hands-on scenario simulation practicum, known as *Advanced Disaster Life Support (ADLS)* in a workshop using network of high-fidelity medical casualty simulators (Program Executive Office for Simulation, Training, and Instrumentation Command
- [PEOSTRI]).
- The final day will be devoted to the AAR process and a Senior Leadership Symposium for joint collaborations and development of potential new partnerships.

2

CONSEQUENCE MANAGEMENT 2003

SARS Transmission Dynamics

- The epidemic to date has been characterized by two large clusters—initiated by two separate ***Super-Spread Events*** (SSE) - and by ongoing community transmission.
- Fitting a stochastic model to data on 1,512 cases, including these clusters, shows that the etiological agent of SARS is highly transmittable.
- Excluding SSE, the authors estimate that 2.7 secondary infections were generated per case on average at the start of the epidemic, with a substantial contribution from hospital transmission and initiated by SSE. On the other hand, in the absence of such effective measures, SARS has the potential to spread very widely.
- Considerable effort will be necessary to implement such measures in those settings where transmission is ongoing, but such efforts will be essential to quell local outbreaks and reduce the risk of further global dissemination.

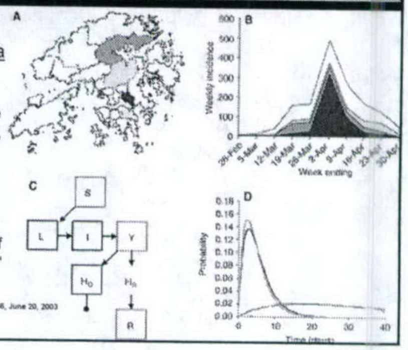
Science, Vol. 300, Issue 5627, 1961-1966, June 20, 2003

3

CONSEQUENCE MANAGEMENT 2003

Events in China

"Super-Spread Events (SSEs) are rare events where, in a particular setting, an individual may generate many more than the average number of secondary cases. "



Science, Vol. 300, Issue 5627, 1961-1966, June 20, 2003

CONSEQUENCE MANAGEMENT 2003

Super Seeding Events (SSE)

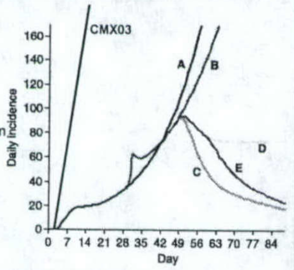
Are responsible for the initiation of the SARS outbreaks in China

Day 0: 50 infections on day 0 are modeled.

Scenario A: No control measures or change in population behavior.

Scenario C: Complete cessation of movement between districts imposed on day 45 (the effect of which is to reduce transmission by 76%).

CMX Scenario: is an intentional SSE with public transmission of SARS to 3,000 people/day by 5 different teams across the Southeast United States.



CONSEQUENCE MANAGEMENT 2003

Stochastic Model is required because of chance fluctuations in case numbers can be large in the early stages of an epidemic

$$R_t = R_t^{\mathrm{XSS}} + p^{\mathrm{SSE}} N^{\mathrm{SSE}}$$

$$R_t^{\mathrm{XSS}} = \beta T S$$

R0$^{\mathrm{xss}}$ - average number of infections caused by one typically infectious individual, Similarly,

Rt$^{\mathrm{xss}}$ - average number of infections, caused by individuals in later generations at time *t*.

These two factors contribute additively to the overall reproduction number *Rt*:

ß - transmission coefficient

T - infectiousness-weighted duration of infection

S - factor representing the effect of geographic heterogeneity and susceptible depletion on disease spread

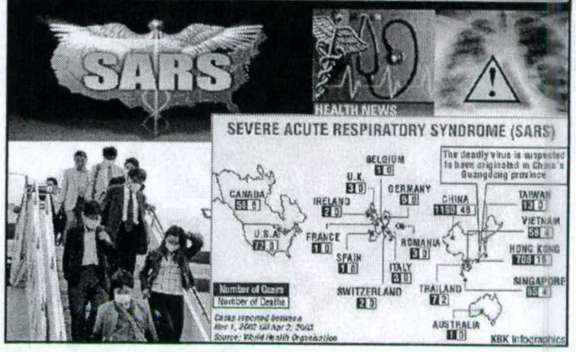
CONSEQUENCE MANAGEMENT

SARS Epidemiology Conclusions for Homeland Security

1. The long-term fate of a SARS outbreak (containment, growth, or endemic persistence) depends on both the typical transmission and the relative frequency and magnitude of SSE
2. Reducing R^{XSS} is the goal of ALL public health intervention strategies.
3. Therefore, Homeland Security and Public Health scenarios must focus on estimating R^{XSS} for future planning.

Epidemiology prediction models are being inserted into the RAMSAFE software for testing during the CMX03. The program will generate morbidity, mortality, and death rates with map overlays for situation awareness and medical command & control for Public Health and all 12 ESFs for HLS FEMA planning.

CONSEQUENCE MANAGEMENT



CONSEQUENCE MANAGEMENT

CMX Objectives:
Consequence Management Exercise – SARS Scenario
Exercise the national NDMS notification for C2 a training environment through participating states to support assistance requests under FEMA.
Exercise - Fort Gordon EOC Coordination Center
Exercise - Federal Coordination Center
Exercise - RAMSAFE software

Background: A group of 10 foreign nationals from China, 2 Saudi Arabia tourists, and 3 U.S. expatriates arrive in the Atlanta Hartsfield International Airport on 20 September 2003. They arrive as "tourists" and pass routine customs screening.

Vector: Topical contamination (Coronavirus - SARS)
Human Factors: Contact with infected material in public places (Public Events, Social conventions)
Country of Origin: China
Environment: Medium to High population density, multiple shopping centers, and high travel capacity to disperse infection from the Southeast, across the US.

RAMSAFE Technologies

CMX03 RAMSAFE Goals

- Medical C4I SR Tool for MTF, RMC, MEDCOM & NDMS
- Organize critical information for planning, training, and the scenario/exercise.
- Emergency response plans, checklists, fact sheets under PAM 525.XX
- Predictive bioterrorism templates
- "Common Operating Picture"
- Organizations and contact information
- Situational Awareness -- maps, floor plans, aerial photos, and pictures
- Wired and wireless video surveillance
- Exercise - Critical Infrastructure Nodes
- State and Local Community
- Responders can Refine Battle Drill
- Unit Training Feedback
- Effectively Identify Vulnerabilities
- SMART and IST/NBC Defense Team coordinated response

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CONSEQUENCE MANAGEMENT

BDLS ADLS

American Medical Association &
MCG's Center of Operational Medicine

- The American Medical Association unveiled in June a basic disaster life support (BDLS) program aimed at rapidly training physicians, physician assistants, nurses and emergency medical technicians for all disasters -- from nuclear attack to fire and flood. The new curriculum will be ready to roll out "by August, and by this time next year we expect it to be offered at training centers nationwide," Dr. James J. James told Reuters Health (16 June 2003)
- The new centers will be part of the AMA's effort to "become the doctor to homeland security," said AMA president Dr. Yank Coble. The new disaster-training curriculum is a cooperative effort of the AMA, the U.S. Department of Health and Human Services (HHS), the Medical College of George and University of Texas Southwestern.
- Among the topics covered in the course are traumatic and explosive events, natural and man-made disasters, biological events, chemical events, medical decontamination, legal issues of disaster response, and media and communications during disasters. James noted that during the anthrax attacks in South Florida, "we had three problems: communication, communication and communication."
- The new course, he said, trains physicians to rapidly disseminate accurate information and to keep rumors to a minimum. Jerome Hauer, acting assistant secretary for the Office of Public Health Emergency Preparedness in HHS, said that prior to the September 11 attacks there was little emphasis on the need to prepare the nation's health care community to respond to disaster. "And we are not just talking about bioterrorism or nuclear attacks," he said. "We are talking about a coordinated response to every emerging infectious disease."

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CONSEQUENCE MANAGEMENT

FEMA Region IV FUTURE CMX Planning

"Regional Training Exercise CMX04 (JSIPP Matrix)"

- Regional CMX provide unique opportunities:
  - Exercise Regional Responders to Training Incident
  - Evaluate Entire Continuum of Response
- The CMX is Joint, City, State, Federal/DoD effort to improve disaster response
- Exercise-based AAR goals are to:
  - Identifies Shortfalls
  - Improves System Response
  - Evaluate New Technology Solutions

FEMA Region IV Interagency Support Group Select Tasks to Exercise

- Scenario selection to evaluate the "Common Operating Picture" for Command & Control
- Exercise scenarios provide the requirements for future interagency training
- Evaluation of standardized training programs like the BDLS & ADLS
- Evaluation of potential technology solutions for Homeland Security
- Realistic training tests emergency response plans and coordination of responsibilities
- Provides direction for future interagency training events

11

CONSEQUENCE MANAGEMENT

SARS POTENTIAL FOR BIOTERRORISM/PUBLIC HEALTH THREAT:

1. SARS as a Model for Bioterrorism Response (May 2003)
2. Hong Kong's "Super Flu" (SARS) and the Threat of Terrorism
3. SARS Bioterrorism by Default or Design
4. Science, Vol. 300, Issue 5627, 1961-1966, June 20, 2003
5. Science, Vol. 300, Issue 5627, 1966-1970, June 20, 2003
6. Science, Vol. 300, Issue 5627, 1884-1885, June 20, 2003
7. Medical Grand Rounds, Medical College of Georgia (April 2003)

NEW REFERENCE CHANGES AND UPDATES:

1. Initial "National Response Plan" (replaces the Federal Response Plan)
2. June 23, 2003 FCC Guidelines (National Disaster Medical System)

12

Local Area Defense Demonstation Meeting

September 15, 2003

National Study Center for Trauma & EMS, Baltimore MD 21202

AGENDA

1) Introductions

2) Nancy Rea, Metropolitan Washington Council of Governments --"*The Washington Metropolitan Regional Emergency Coordination Plan & Health Emergency Readiness*"

3) David Silcott, Applied Sciences -- *" Real-Time Bioaerosol detector and its application to Facility Security and Intubated patient monitoring"*

4) Summary of Campus Evacuation & Rapid Response Teams group meetings

5) Discussion of Time-Lines for LAD Demonstration, Objectives, Participants, Evaluation Metrics

6) Date and time for next meeting

Local Area Biodefense/Surveillance Meeting Notes
September 15, 2003
10 a.m. – 12 noon
National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

Baltimore City Medical Society and UM Specialty Hospitals
James Flynn, MD, Vice President (jflynn@umm.edu)
Federal Drug Administration (FDA)
Nabil Anis, PhD (nanis@cvm.fda.gov)
Maryland Institute for Emergency Medical Services Systems (MIEMSS)
John Donohue, Region III EMS Coordinator (jdonohue@miemss.org)
UM Environmental Health and Safety
James Jaeger, PhD (jjaeger@ehs.umaryland.edu)
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Maryland-Washington Council of Governments
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National Study Center for Trauma and EMS
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Maryland National Guard
LTC. Herb Harris (Herbert.harris@md.ngd.army.mil

The meeting started with introductions of those present (see cover page of minutes). Dr. Mackenzie then introduced Nancy Rea from the Metropolitan Washington Council of Governments who discussed the "Washington Metropolitan Regional Emergency Coordination Plan and Health Emergency Readiness" (Ms. Rea's slides are Attachment #1).

Washington Metropolitan Regional Emergency Coordination Plan is modeled after Federal, State and DC response plans with a focus on communication and coordination. It's all about finding the right people at the right time, coordinators, facilitators and logistics experts. When 9/11 happened there was not an ideal and coordinated response. Arlington performed well and public safety coordinated their activities, but after this and then anthrax it was clear emergency responses needed to improve. With anthrax the need for communication became clear – if people worked in DC they may have their doctor in Virginia. Therefore it was decided an Emergency Coordination Plan was needed with an emergency support function (ESF) structure. We did add some functions not in the Federal plan (see highlighted items in Slide 3) i.e. mass care, food. The most important piece of the Emergency Coordination is (Slide 4) the Regional Incident Communication Coordination System (RICCS) consisting of 3 parts – 1) digital devices, pagers, etc. – key people e.g. health officers have the ability to <u>send</u> messages via a web based system. Usually try to go through the jurisdiction channels first, 2) conference call capability – can be confidential call or open if required. Also working with HHS to use their system to call up to 800 people, 3) incident tracking – this part is not totally worked out yet.

Questions: How often do you exercise this system?

Answer: The RICCS System was used as a true alert at the beginning of SARS – late on Friday. This allowed a conference call scheduling. What should be presented to media – a uniform policy. There were 2 additional conference calls with the alert and others without it on West Nile and Malaria over the past 2 years. Used enough to be comfortable with it. The Health Officers however are not comfortable with sending the messages and we are working on this need – particular if things were happening rapidly.

Before 9/11 a plan had been established for four risk levels to address a bio-agent release in an effort to enhance inter-jurisdictional collaborations. Definitions of risk levels (Slide 6) are helpful in responding to media-nothing going on to everything. No more disease specific planning – rather base response on the generic threat. Disease surveillance would occur that would build on the current infectious disease surveillance/syndromic surveillance in DC and surrounding counties. (Slide 9) This slide shows that a lot of information is obtained from a lot of different non-traditional places. Drug stores/school attendance/personal contacts, etc. Surge capacity task force of hospital and public health officials is examining this issue. Allocation of funding and how to deal with hospital, non-hospital and how hospital aspects of surge capacity are dealt with need addressing.

The challenges are to effectively decide on how to integrate public and private support services and integrate these with public safety without creating conflicts. Cross training and use of standardized protocols across health care, law enforcement and responders, so

that one does not create problems for the others, e.g. health care interfering with law enforcement evidence. Contact information for Nancy Rea is on Slide 12.

Question: How do you credential health care providers, particularly physicians – to cover multiple hospitals?

Answer: Most health officers are MD's although some are MPH's and there are legal issues of course. When we shuttle emergency providers across state lines, DC has a measure that allows doctors and nurses to function in emergencies.

Question: Any State software system for coordinating surveillance data and the responses – or even at City level?
Answer: Yes, the ESSENCE system from JHU is being used as a pilot for DC – this gives them regular updates and different layers of information. The people who contribute data see their own data reported back with some integration.

Question: Is this done by region?

Answer: It can be analyzed down to small areas where public health officers are. Within each state the people who have a license to look at it can see everything. There are still legal problems with giving data from one state to another – they can do it for public health and provide data to CDC, but individual identifiers have been removed. With military involvement, military information cannot become public and vice versa. Firewalls are in place.

Comment about MD/DC/VA (commentary difficult to hear) Emergency Departments.

Question: If an event occurs in Baltimore, is DC going to provide resources to help and vice versa. Second question also relates to how quarantine would be implemented in a place like DC where the majority of workers have live outside and have their families and young children outside DC. How is quarantine or lock-down going to be enforced? What resources will be available to support households with children and no parents?

Answer: This is a really big concern. My understanding is that Maryland has recently revamped their quarantine isolation regulations. DC can probably manage, in Virginia it is going to be a problem. One of the issues that comes up about quarantine – law enforcement wants to know – what is reasonable force? If we have to close down schools (as occurred with SARS in Canada) issues will come up with childcare. In DC many of the children get the majority of their food at school – what happens if schools close down? If parents stay home and are not getting paid – how does the household survive. If its made voluntary – do we then have to go to a court order if it doesn't work? More questions than answers.

Question: If we have a lock down in the hospital here – how do we look after patients?

Answer: In Toronto ¼ of health staff would not come back to work the next day after SARS. A lessons learned seminar on SARS will occur in DC on October 10th.

Comment: There is a difficult situation that arises with a covert biological event when detectors identify it after all those exposed have dissipated. How do you implement lock down? How do you know who has been exposed when with a bio event everyone may feel just fine initially. Quarantine could lead to major civilian unrest and the need for the help of the National Guard.

Question: Air quality monitoring and how to clean up a building.

Answer: The biggest issue who is in charge of the clean up – is the owner or the Federal or State? How do you control this – there are educational issues.

Comment: From John Donohue (MIEMSS) not clear.

Answer: Public Health Department are really very small even when community nurses, etc. are included and they would not be able to cope with the personnel needed to deal with a large bio event, nor are they trained in incident command so that they need someone who the public health groups can work with who knows how to run an incident.

Comment: Again not clear.

Answer: One of the issues with incident command can be – what does one do when the chaplains show up or the trauma specialist shows up – where do these people fit in? We are trying to do some cross training and networking with our mental health personnel. We want to get the right messages to the media that will not panic people – but we need properly worded media release.

There were a series of comments about appropriate levels of back-up and relief for rescue personnel.

Dr. Mackenzie then discussed the draft plan for LAD Demo on UM Campus. It is intended that bio sensor equipment will be deployed on campus in October 2003 (next month). By way of describing the system, Dr. Mackenzie ran through David Silcott's study (Attachment #2) describing the real-time bio sensor system. David Silcott was due to present these, but was asked to continue last weeks testing of the systems with the US Army throughout this week. Dr. Mackenzie showed these slides. The advantage of this system is that it may help in patient management of infection in the airway and it can be tested realistically to see if it is able to detect the admission of necrotizing fasciitis patents (who are vectors for massive amounts of bacteria) into Shock Trauma. The sensors will be deployed to sample air at the entrances to the UM Emergency Department isolation rooms and Shock Trauma entrance. The laser ultraviolet fluorescence system has been used in HVAC systems of buildings. In simulated release in buildings the sensor picked up the agent within minutes, even release 50 yards away or at perimeter fence. This detector can detect all agents and can even be used for chemical agents.

Comment: We need to be developing protocols for hospitals response to infectious agents such as SARS.

Dr. Mackenzie then discussed the proposed LAD Demo (see Attachment #3, for his slides). He identified the primary and secondary objectives.

The draft scenario – Bomb at MIEMSS – blows up Syscom – 9/11 call – BCFD deployed. 1/2 later Sarin release upwind of MIEMSS. The approach is to integrate campus response with incoming city rescuer responses.

Questions: How can this best be integrated? How can optimal use of campus resources occur and how can situational awareness be rapidly transferred to BCFD?

Comments: #1 Need to define objectives and define events. So we need to get small group meetings to discuss details of the plan including BCFD and Police. Each of the key members would identify the objectives of their participation.

#2 The Campus are more realistically going to play a supporting role to the BCFD & BCPD almost from the very beginning. The rapid confirmation of Sarin by the sensors makes it different from other events where there would normally be a significant delay.

#3 We need to determine the timeline and when the demonstration will take place.

The plans are to agree on who will participate in the Demonstration and then find out what these participants feel need exercising in the emergency response to this demonstration scenario. Education is a major component of the preparations. The Haddon Matrix handout contains a draft of what is needed before, during and after the demo. During the event we intend to have rapid detection and confirmatory diagnosis. Lock-down a restriction of occupant movements – stay in place or evacuate. This decision may be impacted by the modeling and plume distribution of Sarin. Dr. David Hartley then briefly described his interest in modeling five different simulation packages, most recently RAMSAFE. Most of the important buildings and population density of Baltimore City is on the downstream side of prevailing Western and North West winds. The message is that this LAD Demo is a model for other similarly strategically placed terrorist targets in US cities and it may have generic applications.

Question: Target for doing this?

Answer: Timeframe – Table top exercise, February 2004, Demo March 2004.

Comment: #1 Spring Break would minimize student numbers on campus.

#2 Should be coordinated with other events going on to be sure there is no conflict, e.g. exam taking in MIEMSS building.

Decide on date fairly soon – to allow others to get things done to support this demonstration.

Question: Is 6 months long enough – seems tight.

Answer: It is tight – but 6 months-one year planning process all ends up by being done in the last 1-3 months. Everyone has other priorities – we never have enough time to do anything as we are all busy – we need a deadline to get it done. MIEMSS has a conference in April that is going to take up a lot of time.

Sensors will be deployed and data integrated so that we can determine sensitivity and specificity (false negative/false positive). Time to detect and time to validation would be included among the sensor performance measures. How are the real-time data integrated with the Homeland Security monitoring the City is doing? Continuous detection of a threat agent needs to be used with the intermittent sampling. How would the city respond to a positive signal on the UM Campus sensors? How do we work with the city to make sure they can benefit from this real-time sensor capability? If we detect a positive signal in our sensors – should the city send a team out to sample their sensors – irrespectively of how recently this was just done – a double check in the system. These all need to be worked out.

Comment: On the deployment of sensors a validation of their data (not clearly heard).

Answer: Our plan was to work with SBCCOM to use hand held sensors and receive validation through their "Telechemist" program. We do not want to trigger a response on the basis of unvalidated data. Getting data on the cost of maintenance of these sensors is also important metrics – each group would develop their own metrics of what they are trying to achieve, i.e. measurable outcomes each participant is trying to achieve with this demonstration. Dr. Mackenzie then went through probable participants (see slides). He described the events after Sarin is released in Tokyo (see slides). The demonstration outcome will be compared to those data. Decontamination facilities in Tokyo were lacking. Disaster management software was not available, two way communications difficult. One of the items to be tested in the LAD Demo will be interoperability of communications. We were to join with Nancy Rea and the RICCS system in DC. MIEMSS will be testing FRED access in PA and SYSCOM backup. The Demo will test the ability to get secondary confirmation of sensor diagnosis and validation. We need to get those prior agreements in place before the excerise.

Dr. Mackenzie showed ALOAHA software modeling of Sarin distribution and discussed his "wish-list" of participants. BCFD was added to the list. School of Pharmacy and Dentistry needs adding – Parking was included under Facilities Management. Add Public Affairs Offices (PR/Communications). State Homeland Security to be added – Dennis Schrader/Tom Lockwood. FBI should be included – through local BCPD. American Red Cross – these will be accessed through MEMA as would FEMA. Testing communication interoperability with Ft. Gordon GA and NATO Brussels.

Dr. Mackenzie got a favorable response from those willing to help in the planning process. The meeting adjourned at 12 noon. Volume 2 of the meetings summary will be copied. Dr. Jon Mark Hirshon brought the Haddon Matrix paper that was circulated for comment. Please provide your suggestions. Dr. Mackenzie probed these in attendance about whether their agency and name should be credited in the Haddon Matrix paper. It was agreed that names should be assigned as the representatives of each of the listed agencies. A second paper on Cholinesterase Assay as a tool for Emergency Department Triage is also under preparation by Dr. Nabil Anis of the FDA. Dr. Hartley will be working with me on some of the modeling of the LAD Demo. Possible future meeting time on Monday.

Table 2. Sample Haddon Matrix for chemical terrorism preparedness showing <u>EDUCATION</u> interventions

	Human Host	Sarin	Physical Environment	Socioeconomic Environment
Pre-Event	-Knowledge of emergency plan -EMS rescuers -Rapid response teams	-Antidotes -Emergency management procedures	-Decon facility -Security -Evacuation routes -Personnel accountability -?Incident command (HEICS)	-Knowledge of risks/agents/effects -Control rumors, disbelief -PPE availability -Training exercises/ evacuation drills -Perceptions of public health
Event	-Rapid, accurate diagnosis -Reaction time & lockdown -Ability to coordinate occupant movement	-Knowledge of sarin dispersal effectiveness by various routes	-Knowledge of building HVAC (cut-off, intake, filter capability) -Established evacuation routes	-Hospital Incident Command System -Emergency Management Plan -EMS ability for rapid sarin identification -Coordination with emergency responders -Current event status awareness -Prior disaster drill experience
Post-Event	-Risk detection -Agent identification -Antidote delivery -Airway/crisis management -Post-mortem management -Collaborative MOUs -Alert sister agencies	-Rapid point-of-care measurement of AchE levels -Hazards of secondary contamination -Clean up/agent disposal	-Ventilator/airway equipment availability -Identification of bed & resource availability -Crowd control/ MOU with security police -Realization of "crime scene" & evidence collection	-Management of psychosocial casualties -Patient information center -Media as public health partner -Use local resources (rapid response teams)

Table 3. Sample Haddon Matrix for chemical terrorism preparedness showing ENGINEERING/ENVIRONMENTAL interventions

	Human Host	Sarin	Physical Environment	Socioeconomic Environment
Pre-Event	-EMS rescuers -Rapid response teams		-Decon facility availability -Building integrity -Security/access to buildings -Chemical sensors -Communications systems -HEICS equipment portability	-PPE availability
Event	-Access by rescuers (improved routes)	-Effectiveness of dispersion (into ventilation system, drains, closed spaces) -Security video cameras -Air analyzer system/ chem-bio sensors/filters	-Communications interoperability -Backup communications system -PPE -Availability of decontamination equipment & areas -Wind detectors	-EMS equipment for rapid sarin identification & treatment -Ability for campus security to coordinate with emergency responders
Post-Event	-Means for antidote delivery -Post-event surveillance (data collection & interpretation) -Decon facility access	-Equipment for rapid measurement of AchE levels -Decon facility	-Backup EMRC -Ventilator/airway equipment availability -Ability to seal off areas to minimize sarin leak -Decon availability -Interoperable communications systems -Refrigeration storage -Isolation rooms	-Interoperability of police/campus/ EMS communications -Develop patient information center -Loss of records

APPLIED SCIENCES L.L.C.

APPLIED SCIENCES

- Performs research & development of advanced real-time biological aerosol detection systems.
- Offers high threat facility security design services specializing in applying protective measures against chemical, biological, and radiological attacks in buildings.

Technology

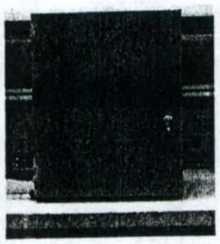
Real-time Biological Aerosol Detection

Technology

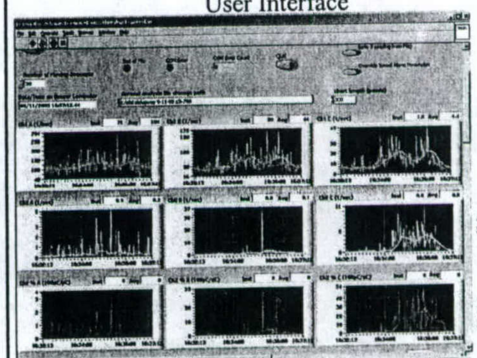
- Detection Principle – simultaneous measurement of an aerosol particle's size, relative fluorescence and complex refractive index.
- Airborne particles are interrogated one at a time with two wavelengths of light generated from laser diode sources at a sampling rate of 1-30 liters per minute.
- The entire air stream is illuminated giving a lower detection limit of a single particle.

Product Configuration

- **Real-time detection of biological & non-biological aerosols**
- **Easily configured to sample air from building's air intake & return locations**
- **Programmable alarm levels**
- **Operates 24/7/365 – unattended**
- **Configured for on-site & off-site monitoring**
- **Can be interfaced to a building's access control system for alarm notification**

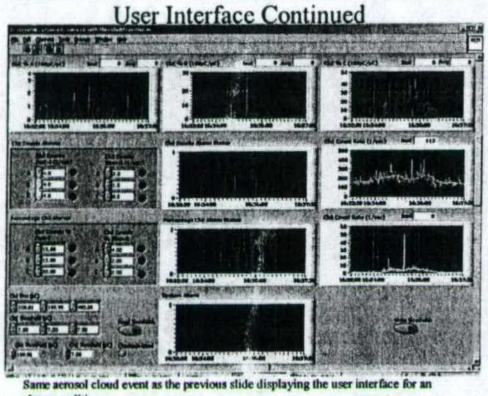


User Interface



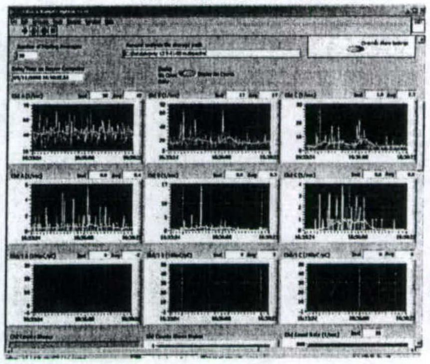
Shown above is the detector's response to a viral agent simulant cloud (MS-2) generated in an Ambient Breeze Tunnel at Dugway Proving Grounds in Utah.

User Interface Continued



Same aerosol cloud event as the previous slide displaying the user interface for an alarm condition.

User Interface Continued



Applications for Hospital Environment

Facility Security

Intubated Patient Monitoring

Facility Security

Teamed with S3I for Facility Security Applications

- Maryland Based Security Firm
  - Completed over 3800 Security Projects
  - High Threat Security System Integrator
- Provider of Aerosol Test & Measurement Systems
  - Real-time Biological Aerosol Detection Systems
    - Mail Biohazard Screening
    - Facility Monitoring
  - Automated Filter Test Systems

Facility Security

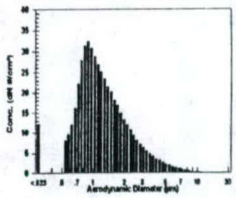
- System is configured to sample the air from a building's HVAC system.
- Has been tested in facilities ranging in size from 30,000 square feet to a couple of million square feet.

Simulated Aerosol Attacks

Aerosol Tracer Tests

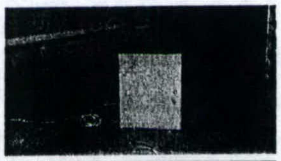
- **Performed with Yellow Visolite Powder**
  - **Visolite is a common HVAC flow tracer (talcum powder based material)**
- **Can generate using either liquid aerosol generators or dry powder dispersers.**
- **Generates particles in the 0.3 micron to 10 micron diameter range.**
- **Able to measure the impact of an aerosol attack using off-the-shelf commercially available aerosol generators.**
- **Able to determine the proper placement of detection systems based on in-place measurements at the actual facility.**

Aerosol Distribution

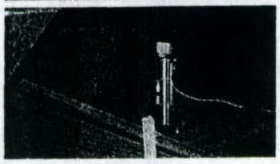


Placement of Detection System at Air Return Location

Detection System
Placed in
Air Return Locations



Aerosol Concentrator
Placed on
Air Return Grills

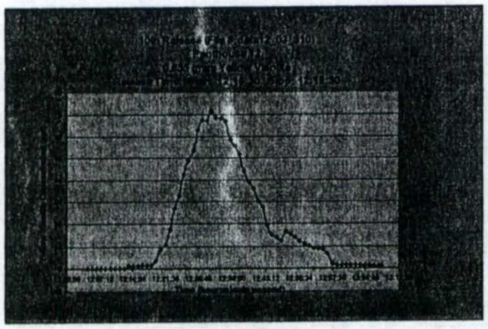


Aerosol Generators Used in Test

Dry Powder Disperser

Liquid Aerosol Generator

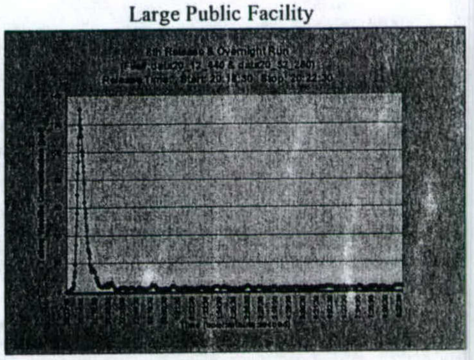
Large Public Facility



Aerosol was released during public hours using a hand-held dry powder disperser. Air return was located on the roof.

ppl = particles per liter of air

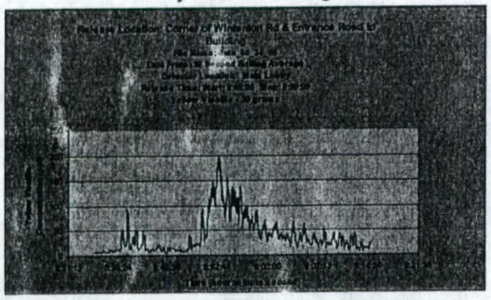
Large Public Facility



Aerosol was released during public hours using a hand-held dry powder disperser. Air return was located on the roof.

ppl = particles per liter of air

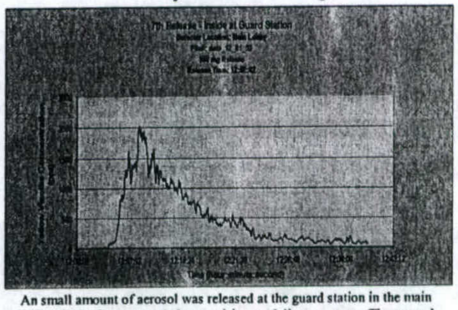
4 Story Office Building



Yellow Visolite aerosol was released outside perimeter fence approximately 50 yards from the building. First cloud at 8:40 was due to an aerosol release during setup.

ppl = particles per liter of air

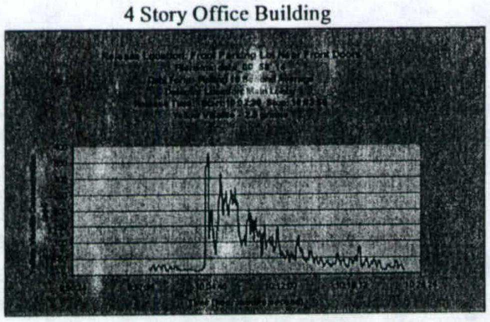
4 Story Office Building



An small amount of aerosol was released at the guard station in the main lobby simulating an attack from a visitor or delivery person. The aerosol release was not visible to the human eye.

ppl = particles per liter of air

4 Story Office Building



Yellow Visolite aerosol was released inside the perimeter fence in the parking lot near the front doors.

ppl = particles per liter of air

APPLIED SCIENCES

Contact Information:

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Washington Metropolitan Council of Governments Regional Emergency Coordination Plan
and
Health Emergency Readiness

Nancy Rea, Manager
Health, Mental Health
& Substance Abuse

1

Regional Emergency Coordination Plan

- **Modeled after Federal, state and District Response Plans**
- **"ESF" Structure**
- **Focus on Communication and Coordination**

2

Regional Emergency Support Functions

1. **Transportation**
2. **Communication**
3. **Public works**
4. **Firefighting**
5. **Information & Planning**
6. **Mass Care**
7. **Resource Support**
8. **Health**
9. **Urban Search & Rescue**
10. **Hazardous Materials**
11. **Food**
12. **Energy**
13. **Law Enforcement**
14. **Media Relations& Community Outreach**
15. **Donations/Volunteer Mgt.**

3

RICCS

- **(REGIONAL INCIDENT COMMUNICATION COORDINATION SYSTEM)**
  - **WEB BASED DIGITAL DEVICE ALERTING ROAMSECURE™ SOFTWARE**
  - **CONFERENCE CALLS**
  - **INCIDENT TRACKING**

4

Bio-Terrorism Concept of Operations Plan

- **To address 2 scenarios:**
  - **The announced release of a bio-agent**
  - **The slow, progressive infectious disease event which manifests itself in scattered clusters of cases throughout the region**
- **To enhance inter-jurisdictional response coordination**
- **Four alert/risk levels**

5

4 Risk Levels

- **Level 4 Risk Assessment:** No active threat—passive surveillance — Everyday communications channels
- **Level 3 Risk Assessment:** Abnormal trigger—active surveillance
- **Level 2 Risk Assessment:** Suspicious bio-event identified — May pose a regional threat
- **Level 1 Risk Assessment:** Confirmed bio-event

6

Regional Health Priorities

- Communication
- Collaboration
- Increased infrastructure

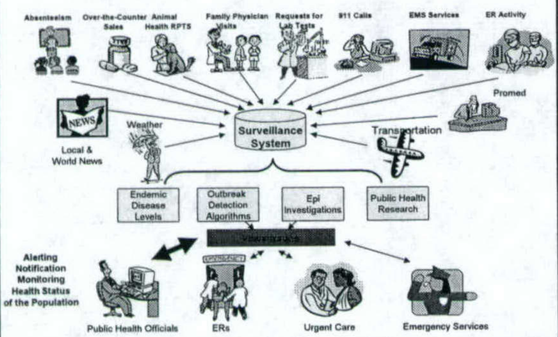
7

Bio-Surveillance

- Report infectious diseases
- Track syndromic data
- Environmental bio-detection

8

Concept for Aggressive Bio-Surveillance Using Non-Traditional Indicators



Surge Capacity

- Public health surge
  - Epidemiology
  - Risk communications
- Hospital surge
  - Staffing
  - Equipment
  - Space
- Non-hospital surge
  - Private practice
  - Home care
- Non-health aspects of surge

10

Challenges

- Moving into the spotlight
- Integration of public and private services
- Integration with public safety

11

Contact information

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12

Local Area Biodefense/Surveillance Meeting Notes
October 9, 2003
10 a.m. – 12 noon
National Study Center for Trauma & EMS
701 West Pratt Street
Baltimore Maryland 21201

Participants

UM Public Safety
Colonel Cleveland Barnes, Asst. Director Public Safety (cbarnes@police.umaryland.edu)
Maryland Institute for Emergency Medical Services Systems (MIEMSS)
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Baltimore City Fire Department
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LTC Kenneth Hyde, Hazardous Materials Coordinator (kenneth.hyde@baltimorecity.gov)
Baltimore City Police Department
George McClaskey (george.mcclaskey@baltimorepolice.org)

Thanks for meeting yesterday.

Decisions

1) Proposed dates for Tabletop = Friday, February 27 tentatively 9a.m. – 12 noon (may finish in 2 hours)

2) Proposed dates for LAD Demonstration = Friday March 26th 10 a.m. – 2 p.m.

   Please all check for conflicts that are possible with these dates and times. For UM Campus these are Spring Break dates and President Ramsay has no conflicting campus events scheduled. BCFD/BCPD/BCHD please check.

   I would like to have these dates confirmed ASAP.

3) **Next meeting Thursday, October 23rd, 1p.m.-2:30 p.m. at National Study Center.**

Attached is a file of the objectives that I noted for each of you.

Draft Scenario: "Dirty Bomb" activates radiation sensors on UM Campus and Dirty Bomb is planted outside Shock Trauma. Dirty Bomber then contacts media who first think this is a hoax or due to a medical Isotope trigger. To make people realize this is a serious threat the Dirty Bomber then uses conventional explosives that damage the MIEMSS building power supply and emergency generator, shutting down SYSCOM.

Attachment

AGENCY	OBJECTIVES	TRIGGER EVENT
NSC	1) Test real time sensors 2) Integrate with City data 3) Assess usefulness of campus video review 4) Interoperability of video communication 5) Test added value of audio & video. 6) Test hand held wireless PDA of video 7) Test ambient data in high public traffic areas on UM campus.	1) "Dirty Bomber" 2) Radiation sensor alarms 3) Need to view radiation sensor site 4) Need for incident command ,C+C to view dirty bomb site remotely 5) Need for remote decision maker to communicate with UM campus/1st respond 6) 1st responders need shared image to know what C&C can see. 7) Assess background radiation from medical Isotopes to know where to set radiation sensor alarms.
UMMC	1) Test communication between UMMC and – UMAB Emergency Management Team – Campus Police – VAMHS – FRED/MIEMSS – BCFD – ABC Notification and alert announcement – Group page – Internal (Command Center to other areas & vice versa) – Intranet and Internet communications 2) Assess ability to limit access to and egress from Medical Center 3) Set up the incident Command Center utilizing HEICS 4) Assess UMMC's capability to handle "worried well" 5) Test UMMC decontamination process	1) Call from media about "Dirty Bomb" planting 2) Radiation from "Dirty Bomb" 3) Need for remote decision-makers to avoid exposure to radiation 4) Massive # of employees/patients crowding ED/STC 5) 100 people found to have radiation on clothing and skin

AGENCY	OBJECTIVES	TRIGGER EVENT
UMB EMS	1) Determine EMS response effectiveness, when Emergency Management Team activated 2) Assess response to finding source of radiation 3) Test adequacy of training equipment and resources to find "dirty bomb" and differentiate it from medical Isotopes. 4) Test consequence management: Neutralize "Dirty Bomb" with lead screening, assess extent of radiation contamination. 5) Test collaboration with Facilities Management, Campus Police, UMMC in implementation of Campus Emergency Management Plan including lock-down and shelter-in-place. 6) Test resource/personnel sharing with BCFD in decontamination.	1) Radiation sensor alarms 2) "Dirty Bomb" planted 3) Media reporting that this is a hoax and due to medical Isotope. 4) Bomb site found. 5) Need to prevent personnel entering or leaving UMMC/STC until radiation contamination extent and safe exit route established. 6) BCFD personnel need decon duty breaks for R&R and rehydration.
UM CAMPUS POLICE	1) Test communication with EMS/Facilities Management. 2) Test video surveillance of campus to see radiation sensor trigger area. 3) Implement "lock-down" and shelter-in-place. 4) Test communications with BCFD, BCPD, Bomb Squad, Campus/UMMC command & control. 5) Identify safe haven & exit route to relieve lock-down.	1) Radiation sensor triggered 2) Need to review historic data to see what occurred, who was visible when radiation sensor triggered. 3) Unknown site and extent of radiation threat 4) Explosion at MIEMSS need bomb squad to determine if 2nd "bomb". 5) Need to restore exit/entry for patients, medical emergencies, etc.
Facilities Management	1) Test Emergency Management plan. 2) Test implementation of lock-down and shelter-in-place.	1) Radiation sensor trigger 2) Dirty Bomb detected and extent of radiation threat determined.

AGENCY	OBJECTIVES	TRIGGER EVENT
MIEMSS	1) Test shelter-in-place plan. 2) Test EMRC back-up. 3) Test SYSCOM back-up abilities to access FRED. 4) Test communications interoperability with DC, PA, VA and others and determine technology and organizational barriers.	1) Radiation threat identified. 2) Explosion destroys MIEMSS power supply and back-up generator. 3) Need for EMS communication & assessment of emergency facilities and resources. 4) Need to warn others of terrorist attack.
BCFD	1) Test Unified Command BCFD/UMB/UMMC/BCPD. 2) Establish Incident Command location at UMB. 3) Test interoperability of campus video surveillance and wireless PDA usefulness to incident commanders and command and control.	1) Confirmation of Dirty Bomb planting 2) Determination of the site and extent of radiation threat. 3) Need for communication throughout UM campus, with first responder, BCPD AND BCHD and others in the ladder of communication.
BCHD	1) Test response to need for medical information on Dirty Bomb. 2) Test access to and distribution of iodine pills and arrange follow-up of radiation positive individuals.	1) Media reports of medical Isotope vs. dirty bomb causing radiation sensor alarm. 2) Need to investigate effects of radiation and provide longer term follow-up.
BCPD	1) Apprehend "Dirty Bomber" 2) Determine criminal/terrorist link. 3) Collect evidence.	1) Planting of Dirty Bomb. 2) Need to prevent repeat terrorist threat. 3) Need prosecution.

Goble, Virginia (Ginny)

From: COLIN MACKENZIE, MD [cmack003@umaryland.edu]
Sent: Friday, November 14, 2003 5:29 PM
To: yxiao; Dischinger, Pat; Jon Mark Hirshon, MD, MPH; oglivie; ron.poropatich; Johnson, Cheryl; Goble, Ginny; Hdickler@som.umaryland.edu; J. Glenn Morris, Jr.; hstandiford@umm.edu; Edward Cornwell; Mary Leach; william.beninati@pentagon.af.mil; Greenberger, Michael; John Krick; David Blythe; Julie Casani; Jeffrey Roche; 'mdonnenb@umaryland.edu'; Conrad Clyburn (E-mail); pbeilenson; jspearman@umm.edu; Stringer, Jeanne; mlevine; nkossi.dambita; ruth.vogel; jcampbel; parker; tganous; ralcorta; Steiger, George E LTC SBCCOM; rrothman@jhmi.edu; dburke@jhsph.edu; dtaylor@jhsph.edu; gkelen; jdonohue; Grove, James W. LTC; jflynn; gzimmer1; banderso; jarose; smvarney; rthompso; tshirtman45; jerry.stockton; pat.redmiles; dfloccare; rbass; ptate; wfmorgan; pkbuckm; dwhyne; ganderson@cbmse.nrl.navy.mil; Craig Thorne; Donald Lumpkins; eballard; mrippleocme; jmt764; divezul; robert.mercer; cbarnes; cburmast; Roger Shere-Wolfe; tlockwood; jjaeger; rrowan; jhill; John.Magness@med.va.gov; Anis, Nabil A; daniel.barnett; herbert.harris; chiefinvestigator; marcus.johnson; lpelletier; robin.rossiter2; kevin; Thompson, Gay D Ms Geneva; Young, Wayne S Mr NARMC-Wash DC; Whitlock, Warren L COL CTA; Alex Menkes; aorlova; dsilcott@apsci.us; kbergmann; nrea; dschrader; David M. Hartley
Subject: Full LAD demo meeting Dec 2nd 10-12 Noon at NSC

We will be having a meeting of the full LAD Demo group , Dec 2nd 10 am - 12 Noon at NSC (701, W.Pratt St - 5th Floor) Please bring Parking sticker for validation .Pastries will be served

AGENDA

1) Summary Description of Local Area Defense Demonstration
   dates :- Table Top Exercise , Friday Feb 27th 2004, 9 am - 12 Noon
   Demonstration Date , Friday March 26th 2004 , 10 am - 2pm
2) Break up into Special Interest Groups to discuss details of the responses to the outlined scenario
3) Future Plans , funding Submissions , Paper write -ups
4) Next meeting date

HAVE A GREAT THANKSGIVING

See you at 10 am , Tuesday Dec 2nd at NSC

Colin Mackenzie

LAD Demo Meeting

January 20, 2004
10:00 am to 12 Noon
National Study Center for Trauma and EMS (NSC)
701 West Pratt Street, Room 531

AGENDA

1) Welcome and Introductions

2) Distribution of LAD Demo Plan with revisions since last meeting in December and discussion

3) Discussion Table Top Exercise February 27 – All

4) Public Relations – Larry Roberts

5) Interoperability Audio and Video (surveillance)
   Communication and Sensor Alarm Notification
   Peter Hu, Colonel Cleveland Barnes and James Jaeger

6) Evaluation Meeting for LAD Demo

7) Tasks for Completion by next LAD Meeting on February 10, 10 a.m. to 12 noon

Parking: Penn Street Garage (corner of Pratt and Penn Streets) Directions: From I-395 to MLK Blvd, at second light, right on to Pratt Street. The Penn Garage is on the left). Please bring tickets for validation.

Pastries and refreshments will be served.

M:\Agenda LAD 1-20-04.doc
2/26/2004

Last LAD Planning Meeting before Table Top Exercise

Date: Tuesday, February 10, 2004
Time: 10 am to noon
Place: National Study Center for Trauma and EMS
701 W. Pratt Street, 5^{th} Floor, Room 531

Agenda:

1) Welcome and Introductions
   a. Distribution for Comments: Draft Plan for Table Top
   b. Rules of Table Top Scenario Plan
   c. Table Top Exercise Scenario
   d. Executive Summary of Table Top

2) Review and Revision of Table Top Invitee List

3) Input by Baltimore City Police Department

4) Input by Baltimore City Fire Department

5) Input by Campus Emergency Management Team

6) Input by Campus Police

7) Input by UMMC

8) Discussion

9) Dates and Times for Next Meetings

Parking: Penn Street Garage (corner of Pratt and Penn Streets) Directions: From I-395 take MLK Blvd exit, make a right at second light on to Pratt Street. The Penn Garage is on the left). Please bring tickets for validation.

Pastries and refreshments will be served.

Articles

Articles

Injury Prevention 1998;4:302-307

METHODOLOGIC ISSUES

Using the Haddon matrix: introducing the third dimension

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Keywords: Haddon matrix; program planning; injury control

William Haddon Jr developed his conceptual model, the Haddon matrix, more than two decades ago applying basic principles of public health to the problem of traffic safety.[1, 2] Since that time, the matrix has been used as a tool to assist in developing ideas for preventing injuries of many types. As such, it provides a compelling framework for understanding the origins of injury problems and for identifying multiple countermeasures to address those problems. However, users then must decide for themselves among the alternatives. This paper adds a third dimension to the matrix to facilitate its use for making decisions about which countermeasures to apply.

Haddon's matrix

The matrix of four columns and three rows combines public health concepts of host-agent-environment as targets of change with the concepts of primary, secondary, and tertiary prevention.[3-4] More specifically, the *factors* defined by the columns in the matrix refer to the interacting factors that contribute to the injury process (see tables 1 and 2). The host column refers to the person at risk of injury. The agent of injury is energy (for example mechanical, thermal, electrical) that is transmitted to the host through a vehicle (inanimate object) or vector (person or other animal). Physical environments include all the characteristics of the setting in which the injury event takes place (for example a roadway, building, playground, or sports arena). Social and legal norms and practices in the culture are referred to as the social environment. Examples include

norms about child discipline or alcohol consumption or policies about licensing drivers or sales of firearms.

View this table: *Table 1 Haddon matrix applied to the problem of residential fires caused by cigarettes igniting upholstered furniture*
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View this table: *Table 2 Haddon matrix applied to the problem of school violence by firearms*
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The *phases* in Haddon's initial configuration referred to rows in the matrix. These are the phases at which change would have its effect—pre-crash, crash, or post-crash. These have been broadened beyond the motor vehicle arena to encompass other injury problems by using the terms "pre-event," "event" and "post-event". Thus, by identifying interventions that fit within each cell of the matrix one can generate a list of strategies for addressing a variety of injury or other public health problems.

How to use the Haddon matrix

As indicated in table 3, the first step in planning, whether using the matrix or any other technique, is to identify clearly the problem to be addressed using appropriate data from the community to assess need. Before using the matrix to derive potential interventions, it is necessary to identify the injury issue to be addressed; for example, falls from playground equipment, bicycle crashes, bathtub drownings, child physical abuse, or residential fires. Second, one needs to define each row and column of the matrix. For example, as in table 1, the host is the child in the home experiencing the fire. The vehicles in this example are the cigarettes, matches, or flammable upholstery fabrics. The home and its immediate environs, including adjoining structures (for example a garage) represents the physical environment. The social environment refers to the social norms, policies, and procedures that govern such practices as how buildings are constructed, installation of smoke detectors, the use of space heaters, and the use of alcohol by residents.

View this table: *Table 3 Steps in using the three dimensional Haddon matrix*
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Most injuries are the result of a sequence of events representing a continuum of activity, rather than a

discrete moment in time defined as the event. Consequently, it is critical that the rows of the matrix also be defined carefully. In most situations, the event could be defined in a variety of ways depending on one's perspective. In the residential fire and school violence examples provided in tables 1 and 2, the event might be defined as the moment the cigarette is dropped in a wastebasket, or the point at which the sofa ignites or when the room is engulfed in flames, or when the whole house is on fire, or when the child is overcome by carbon monoxide. Likewise, in the case of school violence, the event might be the time the teenager takes out the firearm from his or her backpack, the moment he or she points it at a crowd on the playground or the point in time when it is fired, or when it strikes another individual.[5] The choice is arbitrary, but is important so as to anchor one's thinking about what comes before and after the event.

Once both dimensions of the matrix have been carefully defined, individual or group brainstorming is useful to generate ideas about interventions in each of the cells. If participants are from different disciplines, they will bring different perspectives to the problem and to solutions, enriching the overall pool of ideas. By applying the principles of brainstorming in which all ideas are recorded without critical comment before discussion, the process can yield a wide variety of options.

In this process it is frequently tempting, but incorrect, to identify the phase of the strategy in terms of when the strategy was put into place. For example, the smoke detector or sprinkler system was installed as the house was being constructed. However, it has its effect at the time of the event (that is when the smoke filled the room and the detector sounded). Consequently, the smoke detector is properly classified as an event phase strategy. A pre-event strategy would be redesigning cigarettes so they self extinguish before having a chance to ignite upholstery. When filling in the cells of the matrix, a sentence completion exercise can be helpful. That is, one might state: "...... (idea) is an intervention to affect a change in ...... (factor), having its effect at the time of ...... (phase)."

Examples of completed matrices for residential fires and school violence appear in tables 1 and 2 respectively. For many injury problems, particularly those involving repeat occurrences, strategies identified in the post-event phase may actually be effective as pre-event strategies for a subsequent event. For example, efforts to deal with a violent offender are often directed at avoiding a future violent offense. Consequently, the strategy is both post-event in the context of one event and may be pre-event in the context of preventing the occurrence of future events. Similarly, efforts to punish and rehabilitate a drunk driver who has had a crash (a post-event strategy) serves as a pre-event strategy for future potential incidents.

Expanding the matrix for decision making

Once alternative intervention strategies are identified, program planners and decision makers need to choose among the strategies. By applying principles of policy analysis,[6–8] this process can become systematized, permitting concrete articulation of those values that guide the decision process.

Policy analysis typically involves a series of steps including: problem identification, identification of alternative policy options, and identification of values to be assessed relative to each option. Then the analyst uses a process by which each option is assessed according to the extent to which it adheres to the values identified as important. Following this, the analyst chooses among the options. Once they are implemented, others can evaluate their success and the information can be incorporated into future analyses of alternatives. The policies or other interventions considered can be new or may reflect policies or programs already in place.

The third dimension of the matrix proposed here incorporates the use of value criteria in the decision making process (fig 1). Each needs to be carefully thought through in the context of the injury countermeasure being considered, whether a policy (for example drinking age laws), a program (for example training of bartenders not to serve underage or inebriated customers), or a technological intervention (for example ignition interlock device).

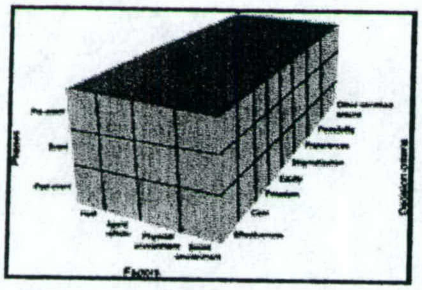

Figure 1 Proposed three dimensional Haddon matrix.

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The assessment process can be done either quantitatively or qualitatively. To accomplish the task, the decision maker must determine the relative weights to be placed on each value—for example, how much is the cost of conducting the intervention to be valued compared with the potential effectiveness of the intervention when applied. Though this process is not easy, it has the potential to be extremely helpful in encouraging a community group or agency board to consider and articulate what factors are important determinants of their decisions.

SELECTING VALUE CRITERIA

Social policy analysts suggest some standard criteria for evaluating all policies, with additional ones often added for specific problem areas.[6–9] For example, a list of values pertinent to motor vehicle safety at railroad crossings were suggested by Wakeland, as referenced in Waller's book, *Injury Control*.[10]

A set of value criteria are listed here only as suggestions to provide a starting point for injury intervention planners. Such criteria will vary according to the injury problem and the setting. Likewise, the types of information available for assessing each also will differ. Suggested criteria include: effectiveness, cost, freedom, equity, stigmatization, preferences of the affected community or

individuals, and feasibility. As described below, each has several dimensions. For each, there are various ways one might determine how well a given countermeasure embodies a particular value criterion.

Effectiveness

Central to any discussion of public health interventions is the criterion of effectiveness; in other words, "How well does the intervention work when applied?" To assess effectiveness of a particular intervention, one might use information available from the literature describing the efficacy of the intervention under controlled conditions or effectiveness of applications of the intervention in other locales. Assessment may require estimation based on information about similar types of interventions associated with other problems or related dimensions of the intervention. For example, the planner might estimate the effectiveness of a media campaign about smoke detectors based on what is known about the effectiveness of media campaigns to encourage use of some other device such as cabinet safety latches or bicycle helmets.

Cost

Cost of an intervention activity can be considered in several ways. One way is to consider the costs of implementing and enforcing the program or policy—for example including expenses associated with such elements as advocacy efforts, promotional activities, implementation of the program, or enforcement of a law. In addition, the planner might separately assess who bears the costs of a particular program and value the criterion differently according to how the costs are borne by different parties affected—for example, by potentially injured persons or their families, the taxpayers, or the manufacturer of a product. It is also appropriate to balance these costs with those associated with choosing not to implement the intervention.

Freedom

With most public health interventions, the freedom of some group may have to be compromised to achieve the intended goal.[9] For example, motorcyclists sacrifice freedom to ride unrestricted when a helmet law is passed. Manufacturers required to make children's sleepwear from flame resistant fabrics have their freedom restricted. In some cases, the freedoms of one group are in conflict with those of another. For example, when a government decides to permit the carrying of concealed guns, those members of the community who wish to carry guns experience an increase in one type of freedom while those wanting to be free from encountering a gun carrying citizen lose freedom. Though freedom is often a critical issue in debates about public health interventions, metrics for assessing this value generally are inadequate. Rather, consideration of the freedom dimension usually is based on personal judgments that may be informed by opinion surveys.

Equity

Both horizontal and vertical equity are important concepts in the policy debate and equally apply to other types of program deliberations. *Horizontal equity* involves treating people equally or in a universal fashion.[6] Federally applied policies typically are horizontally equitable. For example, US requirements

that poisonous substances be packaged in childproof containers protects all children equally. In contrast, *vertical equity* refers to the unequal treatment of unequally situated individuals so as to make them more equal with respect to a particular attribute, such as injury risk. For example, a community smoke detector giveaway program might target low income persons or residences in high fire neighborhoods to help them have the opportunities to protect their homes equal to those of more affluent families.

Stigmatization

The criterion of stigmatization, or avoidance of stigmatization, typically refers to the concept that a program or policy should not stigmatize a person or group in the process of serving other purposes. For example, many would consider it undesirably stigmatizing for schoolchildren to have to identify themselves as low income in order to be eligible to receive a free bicycle helmet. In some situations, however, stigmatization may be considered desirable. For example, some argue that public identification of prior sex offenders is an appropriate strategy for reducing future crimes.

Preferences of the affected community or individuals

If a population exposed to an intervention is opposed to the strategy, compliance is likely to be limited. In addition, the perceptions of the community about the suitability of a particular intervention may reflect whether the intervention has appropriately taken into account the sociocultural context in which the injury problem exists and in which the intervention is to be implemented. Not only is this important for the success of a particular intervention, but also for the credibility, over the long term, of the public health or injury control organization or decision making body responsible for the intervention.

Feasibility

Intervention feasibility is important to consider in several ways but not until all other elements are considered. By considering feasibility too early, creativity may be stifled and options excluded that may, in fact, be judged highly desirable by other criteria. Sometimes what might be judged unfeasible at the outset can be made feasible if sufficient other values support efforts to attempt innovations so as to implement the strategy. For example, until sufficient public demand is present, efforts to require safer playgrounds in child care facilities may meet with too much resistance from providers for a feasible solution to emerge. However, with public awareness and demand increased, facility directors may be willing to accept such a policy.

Feasibility has several dimensions, beginning with technological feasibility. That is, can the intervention actually be produced? For example, does the technology exist to produce fire safe cigarettes or airbags suitable for young children? If the answer is "yes" then it is useful to consider political feasibility. This frequently relates to the issue of preferences discussed above. One might consider if the intervention raises significant political issues such that implementation is unlikely or compromised in some way. For example, a proposed ban on the sale of handguns in the US, while potentially effective in reducing certain types of homicide and suicide, would be met with intense political opposition that would limit the feasibility of the intervention being implemented in the near future, but perhaps not in other

countries. Another element of feasibility is the extent to which the organization or group responsible for implementing the countermeasure has the technical or financial resources required to carry it out. For example, providing crossing guards at all crosswalks before and after school won't work in a community that has too few volunteers to perform the task or too little money to hire them.

USING THE THIRD DIMENSION

Using the third dimension involves several steps, as listed in table 3. After steps 1–3 have been completed in forming the outline for the original Haddon matrix (but before completing it) one must determine what values are important to the decision process. As with the other dimensions of the matrix, each element needs to be carefully defined. At step 4, the planning group determines which values to consider in the analysis. For example, they may decide that taxpayer cost, intervention effectiveness, homeowner freedom and non-stigmatization of poor people are the values they want to address in their decision making. Step 5 refers to the process of determining the relative importance of each value so that values can be weighted relative to each other. Step 6 involves completing the matrix by brainstorming or otherwise generating a list of potential intervention options. In completing step 7, the planners would collect and examine data about each value relative to each of the interventions under consideration.

In this example, assume they are considering two intervention options to reduce the high incidence of fatal fires ignited by cigarettes in their locale: (a) using paid fire fighters to install smoke detectors, purchased using public monies, in households where residents verified their low income with tax records or (b) requiring that cigarette manufacturers produce self extinguishing cigarettes. As part of step 8, information from fire safety research would help determine the relative effectiveness of smoke detectors, if installed properly, and efforts to mandate cigarette redesign and/or changes in upholstery flammability standards. If appropriate epidemiologic evidence were available, planners would examine the incidence of fires associated with cigarettes and also the evidence about the relative benefits of having a properly functioning smoke detector when a fire occurs. In addition, planners would examine program evaluation research to gauge the effectiveness of smoke detector installation programs in other locales in increasing the prevalence of properly functioning detectors in homes. They would also examine evidence that changes in cigarettes would reduce fire incidence. Likewise, they would want to estimate the costs associated with purchasing detectors and the personnel time required to install them, as well as the costs of developing and enforcing the cigarette safety standards. These costs would be balanced against costs associated with *not* doing each intervention. Similarly, each intervention would be examined with respect to stigmatization and freedom.

The extent to which the options considered span different jurisdictions (for example local *v* federal policy) makes comparisons more complex, but not impossible. This process requires that the planners assemble relevant evidence from varied sources: for example, epidemiologic studies, intervention studies, information from cigarettes or upholstery manufacturing companies, assessment of program costs, and opinions expressed in interviews with residents about issues of stigmatization and freedom. In many cases, there will not be published data available. In those situations, the planners will need either to extrapolate from other information or to make an educated guess. It should be remembered that the point of the process is to guide decision making and that it isn't always possible to conduct a rigorous

scientific analysis in the timeframe required for program development. Often, however, sufficient information will be available from prior scientific studies so that decisions can be based on sound evidence. The more rigorous the sources of data used, the more detailed the analyses can be, and the more confident planners can be that their decisions will result in the desired outcome.

Both new and existing intervention strategies can be compared using the same method. However, the more the analysis involves previously untried strategies, the more difficult it will be to incorporate certain types of evidence in the deliberation. Although it is important to recognize this factor, it should not be allowed to limit creativity.

Once all the information has been gathered to assess each criterion for each of the interventions under consideration, the comparative analysis begins (step 9). Policy analysts or planners employ numerous ways, with varying degrees of complexity, to accomplish this task.[8] They may use a quantitative process involving summing scores for the relative importance of each criterion multiplied by a score representing the extent to which each option possesses the attributes of the criterion. For new interventions this will require some forecasting of the potential attributes of the intervention, once implemented. For interventions that have been tried already, various types of information may be available to quantify the effects, costs, and other attributes.

Qualitative information also can be examined. This might include reviewing testimony about preferences expressed in reference to prior efforts to enact a policy, news clippings giving indications of public sentiment about a proposed program, or reviews of process evaluations of programs or policies implemented in the past to assess potential barriers that could influence effectiveness.

Whether using quantitative or qualitative information, the process needs to be systematic, allowing planners to carefully assess the options. Decision making (step 10) can then be justified and explained in the context of pre-established criteria applied in a rational manner.

It is wise to document the process and record how assessments were made not only so that decisions can be more easily explained to others (step 11) but also so that interventions can be re-evaluated after some period of time using new data that may reflect changes in technology, epidemiology, or the political environment (step 12).

Conclusion

- ▲ Top
- ▲ Haddon's matrix
- ▲ How to use the...
- ▲ Expanding the matrix for...
- • Conclusion
- ▼ Acknowledgements
- ▼ References

Haddon's matrix has been an extremely valuable tool over nearly two decades. As a conceptual model, it has helped guide research and the development of interventions. The addition of the third dimension (fig 1 ⊞) should facilitate its application in decision making. As the three dimensional formulation is applied, users should document successes and problems in using the revised model. Over time, the application of the model in different settings should be shared in the professional literature so that the model can be made even more useful and user

friendly.

Acknowledgements

I am grateful for the assistance of students in my injury class over the past 10 years who have helped me clarify and improve this material. I also appreciate the assistance of Lisa Cohen in formulating the school violence example and the help of Ronda Zakocs and two anonymous reviewers in suggesting improvements to the manuscript. This work was partially supported by a grant from the National Center for Injury Prevention and Control to the University of North Carolina Injury Prevention Research Center (CCR402444).

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Table 1 Haddon matrix applied to the problem of residential fires caused by cigarettes igniting upholstered furniture

	Host (children in home)	*Agent/vehicle (cigarette, matches, and upholstered furniture)*	*Physical environment (home)*	*Social environment (community norms, policies, rules)*
Pre-event (before fire starts)	Teach children not to play with matches	Redesign cigarettes so they self extinguish before ignition of upholstery	Lower flammability of structures	Improve efforts to curb smoking initiation Improve smoking cessation efforts
Event (during fire)	Teach children to stop, drop, and rollPlan and practice a fire escape route with childrenTeach children not to hide during a fire	Design furniture with materials that are less toxic when burned Design upholstery that is flame resistant	Install smoke detectors Install sprinklers Increase number of usable exits	Pass ordinances requiring smoke detectors and/or sprinkler systems Fund the fire department adequately to provide enough personnel and equipment for rapid response
Post-event (after child in injured by fire)	Provide first aid and CPR to all family members	Design heaters with quick and easy shutoff device	Build homes with less toxic building materials	Increase availability of burn treatment facilities

CPR = cardiopulmonary resuscitation.

Table 2 Haddon matrix applied to the problem of school violence by firearms

	Host (students at school)	*Agent/vehicle (firearm and bullets)*	*Physical environment (school)*	*Social environment (school and community norms, policies, rules)*
Pre-event (before teen uses weapon)	Educate teens about the dangers of carrying guns to school Educate parents about dangers of allowing teens access to gunsTeach students to recognize and report student behaviors indicative of possible violent behavior	Modify guns so they are only operable by the owner	Install metal detectors at entrances to schools Eliminate storage places in schools (for example lockers) where guns might be kept	Adopt school procedures/policies to notify authorities if a student is suspected of having a gun at schoolProhibit gun carrying on school groundsEnforce restrictions on the sale or transfer of handguns to teenagers
Event (when gun is taken out to be fired)	Teach students to take cover when they see guns or hear gunfire	Reduce capacity of weapons to fire multiple rounds quicklyModify bullets to be less lethal	Install alarm systems to call law enforcement as soon as weapons are visible	Have law enforcement officers on duty at school to intervene during fightsDevelop safety plans to help students move to safety in event of violent episode
Post-event (after students are shot)	Teach students first aid skill	Reduce the capacity of the gun to continue firing	Make school grounds readily accessible to ambulances	Ensure well trained emergency medical personnel and access to trauma facilitiesProvide post-event counseling to students, staff, and families

Table 3 Steps in using the three dimensional Haddon matrix

Step	Activity
1	Use community needs assessment data to determine the problem in need of intervention
2	Define dimension #1 (columns) of matrix as the targets of change (host, agent/vehicle or vector, physical environment, social environment)
3	Define dimension #2 (rows) of matrix by delineating the precise event and phases of change (pre-event, event, post-event)
4	Define dimension #3 (depth) of matrix by delineating value criteria, defining each in clear terms
5	Determine weights to be applied to each value listed in dimension #3
6	Brainstorm potential interventions and fill in cells formed by columns and rows
7	Organize and/or collect data to permit assessment of each criterion for each intervention under consideration
8	Assess each intervention according to its attributes relative to each value criterion
9	Conduct overall assessment using weights for each value criterion across the set of interventions and criteria
10	Make decisions about best options
11	Explain decisions based on criteria applied and assessment of each intervention option according to the criteria
12	Document the assessment process to assist in future reanalyses

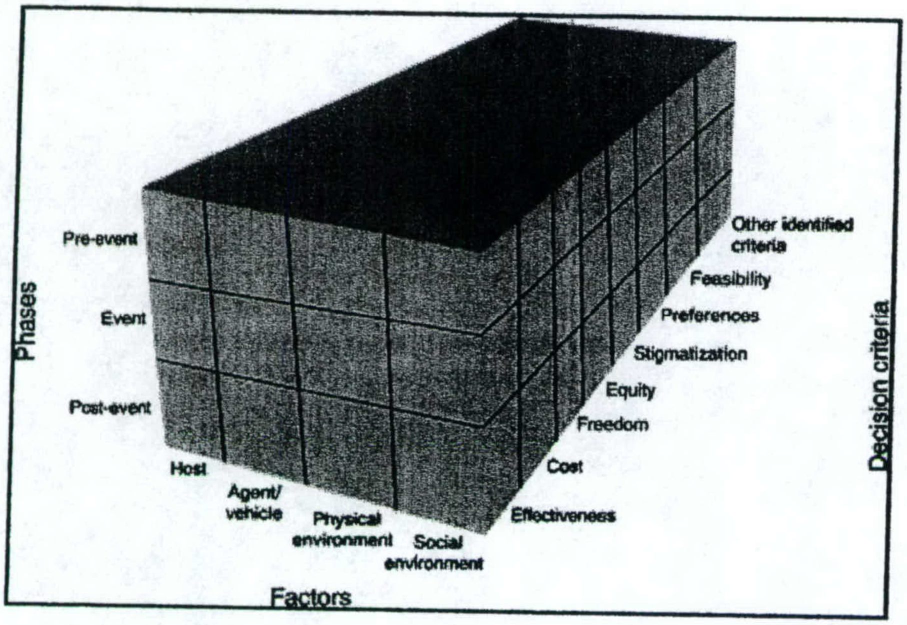

Figure 1 Proposed three dimensional Haddon matrix.

Energy damage and the 10 countermeasure strategies

William Haddon JR, MD

This paper is the first in a series of Injury Classic. Our goal is to reprint one such paper in each issue to initiate newcomers to the field to these old, often quoted, and important contributions. As many are difficult to find, it should help all of us to have a copy at hand. Your suggestions about future articles are welcome. Write to the editor with details of your favourite, most quoted paper.

An important landmark is reached in the evolution of a scientific field when classification of its subject matter is based on the relevant, fundamental processes involved rather than on descriptions of the appearances of the phenomena of interest. In illustration, a fundamental turning point was reached when the debilitation and progressive susceptibility to bruising of shipboard scurvy could for the first time be classified as the process resulting from a deficiency of consumption of something variously present in fruits and vegetables (much later identified as ascorbic acid, vitamin C). In fact, such transition from classifications consisting essentially only of a description of appearances to those based on fundamental processes is basic to scientific progress generally; hence, examples abound from the full gamut of scientific concerns.

Additional illustrations, among the many, include the classificatory and conceptual transitions that followed recognition:

a. That rocks could be grouped on the basis of the processes involved in their formation – as sedimentary, igneous, metamorphic.

b. That the variations among the Galapagos finches studied by Darwin were the result of differential ecologic processes.

c. That earthquakes were one aspect of tectonic processes.

d. That the epidemic disease of the young which could for decades be described only as 'infantile paralysis' was a rare variant of a commonplace process initiated by infection with one of several similar and previously unknown viruses.

e. That plague was a process in which a specific pathogen, *Pasteurella pestis*, rats, fleas, and people interacted.

Extrarational explanations in the absence of process knowledge

Before such conceptual and hence classification advance, lacking an understanding of process, and therefore of the possibility of human intervention or avoidance, phenomena of concern to people have commonly been attributed to extrarational factors. 'Luck', 'chance', 'accident', 'fate' and similar terms are the hallmarks of such ignorance, and perhaps of a human necessity for explaining it away.[8] The distinction between the way in which people tend to deal with the understood as opposed to the merely known-about is illustrated nicely by the renowned anthropologist Malinowski. He found that Trobriand natives viewed the hazards outside the reef, which they did not understand, in ways more supernatural than they viewed those inside the reef, which they did understand. As he wrote, 'It is most significant that in the lagoon fishing, where man can rely completely upon his knowledge and skill, magic does not exist, while in the open-sea fishing, full of danger and uncertainty, there is extensive magical ritual to secure safety and good results'.[16]

Divine punishment as an explanation in the absence of process understanding

The Book of Job epitomizes another commonplace aspect of human response to undersirable happenings not yet understood – and therefore not yet categorized – in process terms. The events are explained as divine retribution for shortcomings. The suffering of oneself, someone else, or some group occurs because it is divine and well-deserved punishment. Therefore, unless the sin can be expiated by appropriate change in behavior, it may be 'too bad', but there is nothing else to be done to ameliorate the personally or societally undesirable happening unless it is an increase in efforts at human reform.

Expanded classificatory sets and different sets

The transition to understanding of underlying, relevant processes commonly results in more than just a relabeling of past groupings.[8] Usually the phenomena previously recognized have been 'the tip of the iceberg', and the recognition of underlying process adds much more. Thus, in the case of what was originally termed 'infantile paralysis', it was found that the infectious process routinely involved hundreds of individuals subclinically for each person ill enough to be diagnosed. Moreover, parallel illustrations are legion, not only from medicine but also widely from other sciences.

For example, understanding the actual nature of earthquakes is to classify them conceptually as one aspect of a far broader range of tectonic processes; and understanding the origins of a butterfly or a clam is to identify it in terms of its life cycle, a process classification. Understanding the process involved in eclipses is to classify them as one aspect of celestial mechanics.

Another frequent result of transition to pro-

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cess based understanding is regrouping phenomena not merely in expanded sets, but in new sets that do not bear a one-to-one correlation with the old. Figure 1 illustrates this. As process (or, to use a related [medical] term, etiologic) understanding advanced, the set of phenomena formerly referred to as 'wasting' was, in effect, parcelled out to such process-defined sets as tuberculosis, amebiasis, protein deficiency, and a host of others.[8]

More relevant here is to view the process in reverse; that is, from the standpoint of the etiologic or process sets in picking up pieces of many pre-existing descriptive sets, as illustrated in figure 2.[8]

Thus syphilis, the etiologic set based on the infectious agent, *Treponema pallidum*, picked up parts of previous descriptive sets, such as paresis, gummas, penile lesions, rashes, certain gastric lesions, certain abnormalities of the growing ends of bone, and many others, but not all of those in any one of the earlier descriptive

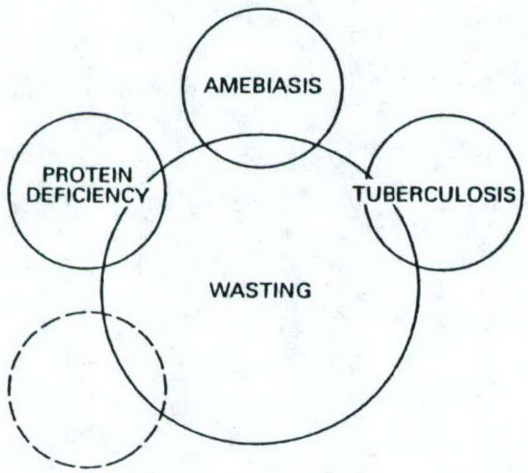

Figure 1 An illustration of the parcelling out to etiologically defined sets of the components of a descriptively defined set of pathology.

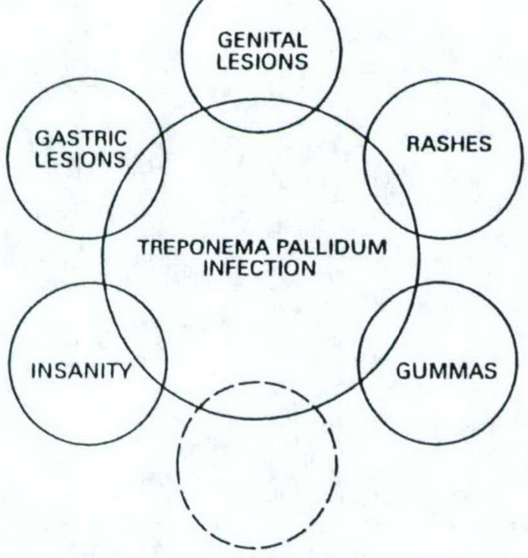

Figure 2 An illustration of the incorporation of portions of various descriptively defined sets of pathology into an etiologically defined set.

usually not in such transitions, a one-to-one relationship between the earlier, descriptive ways of looking at the phenomena and those process-based which are substituted for them.[8]

The foregoing is brief background for that which follows, an introduction to the classification of certain widespread, important phenomena defined and grouped in terms of a small number of closely parallel processes. Most of the included phenomena are not yet regarded in process terms by the implicit and explicit classifications still appplied to them by most professionals and laymen. Yet there is widespread, implicit, and at least qualitative recognition of the processes themselves, because cultures, past and present, abound in actions directed at changing the outcome of these processes through interventions at specific points in their sequences.

Energy damage processes

The phenomena of concern are those involved when energy is transferred in such ways and amounts, and at such rates, that inanimate or animate structures are damaged.[1,6–8,10,14] (Much of the remainder of this paper closely follows reference 10.) The harmful interactions with people and property of hurricanes, earthquakes, projectiles, moving vehicles, ionizing radiation, lightning, conflagrations, and the cuts and bruises of daily life illustrate this class.

10 Strategies for reducing these losses

Several strategies, in one mix or another, are available for reducing the human and economic losses that make this class of phenomena of social concern. In their logical sequence, they are as follows:

The *first* strategy is to prevent the marshalling of the form of energy in the first place: preventing the generation of thermal, kinetic, or electrical energy, or ionizing radiation; the manufacture of gunpowder; the concentration of U-235; the build-up of hurricanes, tornadoes, or tectonic stresses; the accumulation of snow where avalanches are possible; the elevating of skiers; the raising of babies above the floor, as to cribs and chairs from which they may fall; the starting and movement of vehicles; and so on, in the richness and variety of ecologic circumstances.

The *second* strategy is to reduce the amount of energy marshalled: reducing the amounts and concentrations of high school chemistry reagents, the size of bombs or firecrackers, the height of divers above swimming pools, or the speed of vehicles.

The *third* strategy is to prevent the release of the energy: preventing the discharge of nuclear devices, armed crossbows, gunpowder, or electricity; the descent of skiers; the fall of elevators; the jumping of would-be suicides; the undermining of cliffs; or the escape of tigers. An Old Testament writer illustrated this strategy in the context both of the architecture of his area and of the moral imperatives of this entire field: 'When you build a new house, you

shall make a parapet for your roof, that you may not bring the guilt of blood upon your house, if any one fall from it'.[3] This biblical position, incidentally, is fundamentally at variance with that of those who, by conditioned reflex, regard harmful interactions between man and his environment as problems requiring reforming imperfect man rather than suitably modifying his environment.

The *fourth* strategy is to modify the rate of spatial distribution of release of the energy from its source: slowing the burning rate of explosives, reducing the slopes of ski trails for beginners, and choosing the re-entry speed and trajectory of space capsules. The third strategy is the limiting case of such release reduction, but is identified separately because in the real world it commonly involves substantially different circumstances and tactics.

The *fifth* strategy is to separate, in space or time, the energy being released from the susceptible structure, whether living or inanimate: the evacuation of the Bikini islanders and test personnel, the use of sidewalks and the phasing of pedestrian and vehicular traffic, the elimination of vehicles and their pathways from community areas commonly used by children and adults, the use of lightning rods, and the placing of electric power lines out of reach. This strategy, in a sense also concerned with rate-of-release modification, has as its hallmark the elimination of intersections of energy and susceptible structure – a common and important approach.

The very important *sixth* strategy uses not separation in time and space but separation by interposition of a material 'barrier': the use of electrical and thermal insulation, shoes, safety glasses, shin guards, helmets, shields, armor plate, torpedo nets, antiballistic missiles, lead aprons, buzz-saw guards, and boxing gloves. Note that some 'barriers', such as crash padding and ionizing radiation shields, attenuate or lessen but do not totally block the energy from reaching the structure to be protected. This strategy, although also a variety of rate-of-release modification, is also separately identified because the tactics involved comprise a large, and usually clearly discrete, category.

The *seventh* strategy, into which the sixth blends, is also very important – to modify appropriately the contact surface, subsurface, or basic structure, as in eliminating, rounding, and softening corners, edges, and points with which people can, and therefore sooner or later do, come in contact. This strategy is widely overlooked in architecture, with many minor and serious injuries the result. It is, however, increasingly reflected in automobile design, and in such everyday measures as making lollipop sticks of cardboard and making some toys less harmful for children in impact. Despite the still only spotty application of such principles, the two basic requisites, large radius of curvature and softness, have been known since at least about 400 BC, when the author of the treatise on head injury attributed to Hippocrates wrote: 'Of those who are wounded in the parts about the bone, or in the bone itself, by a fall, he who falls from a very high place upon a

sustaining a fracture and contusion of the bone, and of having it depressed from its natural position; whereas he that falls upon more level ground, and upon a softer object, is likely to suffer less injury in the bone, or it may not be injured at all . . .'.[15]

The *eighth* strategy in reducing losses in people and property is to strengthen the structure, living or nonliving, that might otherwise be damaged by the entry transfer. Common tactics, often expensively underapplied, include tougher codes for earthquake, fire, and hurricane resistance, and for ship and motor vehicle impact resistance. The training of athletes and soldiers has a similar purpose, among others, as does the treatment of hemophiliacs to reduce the results of subsequent mechanical insults. A successful therapeutic approach to reduce the osteoporosis of many postmenopausal women would also illustrate this strategy, as would a drug to increase resistance to ionizing radiation in civilian or military experience. (Vaccines, such as those for polio, yellow fever, and smallpox, are analogous strategies in the closely parallel set to reduce losses from infectious agents.)

The *ninth* strategy in loss reduction applies to the damage not prevented by measures under the eight preceding – to move rapidly in detection and evaluation of damage that has occurred or is occurring, and to counter its continuation and extension. The generation of a signal that response is required; the signal's transfer, receipt, and evaluation; the decision and follow-through, are all elements here – whether the issue be an urban fire or wounds on the battlefield or highway. Sprinkler and other suppressor responses, firedoors, MAYDAY and SOS calls, fire alarms, emergency medical care, emergency transport, and related tactics all illustrate this countermeasure strategy. (Such tactics have close paralleles in many earlier stages of the sequence discussed here, as, for example, storm and tsunami warnings.)

The *tenth* strategy encompasses all the measures between the emergency period following the damaging energy exchange and the final stabilization of the process after appropriate intermediate and long-term reparative and rehabilitative measures. These may involve return to the pre-event status or stabilization in structurally or functionally altered states.

Separation of loss reduction and causation

There are, of course, many real-world variations on the main theme. These include those unique to each particular form of energy and those determined by the geometry and other characteristics of the energy's path and the point or area and characteristics of the structure on which it impinges – whether a BB hits the forehead or the center of the cornea.

One point, however, is of overriding importance: subject to qualifications as noted subsequently, there is no logical reason why the rank order (or priority) of loss-reduction countermeasures generally considered must parallel

the sequence, or rank order, ... buting to the result of damaged people or property. One can eliminate losses in broken teacups by packaging them properly (the sixth strategy), even though they be placed in motion in the hands of the postal service, vibrated, dropped, piled on, or otherwise abused. Similarly, a vehicle crash, per se, need necessitate no injury, nor a hurricane housing damage.

Failure to understand this point in the context of measures to reduce highway losses underlies the common statement: 'If it's the driver, why talk about the vehicle?' This confuses the rank or sequence of causes, on the one hand, with that of a loss-reduction countermeasure – in this case 'crash packaging' – on the other.

There are, nonetheless, practical limits in physics, biology, and strategy potentials. One final limit is operative at the boundary between the objectives of the eighth and ninth strategies. Once appreciable injury to man or to other living structure occurs, complete elimination of undesirable end results is often impossible, though appreciable reduction is commonly achievable. (This is often also true for inanimate structures, for example, teacups.) When lethal damage has occurred, the subsequent strategies, except as far as the strictly secondary salvage of parts is concerned, have no application.

There is another fundamental constraint. Generally speaking, the larger the amounts of energy involved in relation to the resistance to damage of the structures at risk, the earlier in the countermeasure sequence must be strategy lie. In the ultimate case, that of a potential energy release of proportions that could not be countered to any satisfactory extent by any known means, the prevention of marshalling or of release, or both, becomes the only approach available. Furthermore, in such an ultimate case, if there is a finite probability of release, prevention of marshalling (and dismantling of stockpiles of energy already marshalled) becomes the only, and essential, strategy to assure that the undesirable end result cannot occur.

For each strategy an analogous opposite

Although the concern here is the reduction of damage produced by energy transfer, it is noteworthy that to each strategy there is an opposite focused on increasing damage. The latter are most commonly seen in collective and individual violence – as in war, homicide, and arson. Various of them are also seen in manufacturing, mining, machining, hunting, and some medical and other activities in which structural damage, often of a very specific nature, is sought. (A medical illustration would be the destruction of the anterior pituitary with a beam of ionizing radiation as a measure to eliminate pathologic hyperactivity.) For example, a marker of motor vehicles or of aircraft landing-gear struts – a product predictably subject to energy insults – could make his product more delicate, both to increase labor and sales of parts and materials, and to shorten which commonplace amounts of damage increasingly exceed in cost the depreciating value of the product in use. The manufacturer might also design for difficulty of repair by using complex exterior sheet metal surfaces, making components difficult to get at, and other means.

The type of categorization outlined here is similar to those useful for dealing systematically with other environmental problems and their ecology. In brief illustration, various species of toxic and environment-damaging atoms (such as lead), molecules (eg DDT and heroin), and mixtures (garbage and some air pollutants, among others) are marshalled, go through series of physical states and situations, interact with structures and systems of various characteristics, and produce damage in sequences leading to the final, stable results.

Similar comments can be made concerning the ecology of some of the viral, unicellular, and metazoan organisms that attack animate and inanimate structures; their hosts; and the types of stages of damage they produce. Actual and potential birth control and related strategies and tactics can be somewhat similarly categorized. Thus, in brief, beginning on the male line: preventing the marshalling of viable sperm (by castration or certain pharmacological agents); reducing the amount of sperm produced; preventing the release of semen (or of one of its necessary components, eg, by vasectomy); modifying the rate of spatial distribution of release of semen (as in hypospadias, a usually developmental or traumatic condition in which the urethra opens on the underside of the penis, sometimes near its base); separating semen release in space or time from the susceptible ovum (eg continence, limiting intercourse to presumably nonfertile periods, coitus interruptus, and preventing a fertile ovum from being present when sperm arrive); separation by interposition of a material barrier (eg, condoms, spermicidal creams, foams, jellies); increasing resistance of the ovum to penetration; making the ovum infertile, even if penetrated; prevention of implantation of the fertilized egg; abortion; and infanticide.

Sufficient differences among systems often exist, however – for example, the ecology of the agents of many anthropod-borne diseases is quite complex, and the life cycles of organisms such as schistosomes require two or more different host species in sequence – to preclude at this time many generalizations useful across the breadth of all environmental hazards and their damaging interactions with other organisms and structures.

A systemic analysis of options

It has not generally been customary for individuals and organizations that influence, or are influenced by, damage due to harmful transfers of energy to analyze systematically their options for loss reduction, the mix of strategies and tactics they might employ, and their cost. Yet is is entirely feasible and not especially

difficult to do so, although specific supporting data are still often lacking. In fact, unless such systematic analysis is done routinely and well, it is generally impossible to maximize the pay-offs both of loss-reduction planning and of resource allocations.

Such analysis is also needed to consider properly the problems inherent in the use of given strategies in specific situations. Different strategies to accomplish the same end commonly have different requirements; in kinds and numbers of people, in the disciplines involved, in material resources, in capital investments, and in public and professional education, among others. In the case of some damage-reduction problems, particular strategies may require political and legislative action more than others. And, where the potential or actual hazard exists across national boundaries, correspondingly international action is commonly essential.

The types of concepts outlined in this note are basic to dealing with important aspects of the quality of life, and all of the professions concerned with the environment and with the public health need to understand and apply the principles involved – and not in the haphazard, spotty, and poorly conceptualized fashion now virtually universal. It is the purpose of this brief note to introduce the pathway along which this can be achieved.

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human beings in automobiles could be "crash-packaged" through the use of safety belts, air bags, and structural changes to the vehicle. By measuring the body's ability to withstand increases in mechanical energy, De Haven helped to establish the central importance of biomechanics in injury prevention research. This area of investigation continues today, drawing its expertise from engineering, physiology, medicine, biology, and anatomy.

De Haven's seminal article was published in 1942. The next landmark in injury prevention came in 1949, when Dr. John E. Gordon suggested that injuries behaved like classic infectious diseases and were characterized by epidemic episodes, seasonal variation, long-term trends, and demographic distribution. Therefore, they could be studied through the same techniques. Most important, each injury, like each disease outbreak, was the product not of one cause but "of forces from at least three sources, which are the host . . . the agent itself, and the environment in which host and agent find themselves."[18]

Gordon's description of the agent of injury (his examples included glass-paneled doors, faulty ladders, and playful pups) was unsatisfying, however. If there were virtually as many distinct agents as there were injuries themselves, prevention would be an impossible task. Little more than a decade after Gordon's article appeared, the puzzle of how to define the agents of injury was solved by an experimental psychologist at Cornell University.

James J. Gibson was not an injury specialist. His general concern was with human and animal behavior relative to the environment. Man, he wrote,

> responds to the flux of energies which surround him—gravitational and mechanical, radiant, thermal, and chemical. . . . Injuries to a living organism can be produced only by some energy interchange. Consequently, a most effective way of classifying sources of energy is according to the forms of physical energy involved. The analysis can thus be exhaustive and conceptually clear. Physical energy is either mechanical, thermal, radiant, chemical, or electrical.[19]

Having arrived at the same conclusion as Gibson, Dr. William Haddon, Jr., of the New York State Health Department modified the energy-transfer analysis to include "negative agents" for injuries produced by the absence of such necessary elements as oxygen or heat.[20] Thus, frostbite results from the absence of necessary energy.

Haddon's landmark contributions extended Gordon's analysis to the development of preventive approaches. We will encounter Haddon's "phase-factor matrix" a number of times in this book. The matrix is actually a series of matrices developed for different purposes and makes explicit the preventive value of the epidemiologic view of injury. In the matrix, the host, agent (or vector), and environment are seen as factors that interact over time to cause injury. (To avoid confusing the actual agent of injury—energy—and the mechanism by which that energy is transferred, the matrix illustrated specifies the vector. The automobile is a vector for physical energy, just as a faulty appliance cord can be a vector for injurious electrical energy.) A Haddon matrix designed around traffic injuries appears in Figure 1.

The precrash phase includes everything that determines whether a crash will take place (the driver's lack of ability or alcohol-related impairment, the car's malfunctioning brakes, the poorly lit curve in the road, or society's attitudes about alcohol consumption). The crash phase includes everything that determines whether an injury results from the crash: Are the occupants wearing safety belts? Is the car large or small? Is the pole they hit designed to break away? Are laws about child safety seats enforced? The postcrash phase determines whether the severity of the injury's consequences can be reduced: Can the bleeding be stopped? How quickly do the paramedics arrive? How effective is emergency room care? Does society support the development of trauma care systems? Haddon's analysis suggested that preventing an injury may require modifying only one of the elements, and there is no essential priority determining which one must be modified (the weakest link in the chain will do). For example, as will be seen in Chapter 6, one potentially effective measure against impaired driving is an in-car breath testing device that prevents the car from starting if the driver is drunk—a modification of the vector, rather than the host. In another major contribution, Haddon later developed a series of 10 classes of injury countermeasures, to which we return later when discussing the main types of injury prevention measures.

The contributions of De Haven, Gordon, Gibson, Haddon, and others helped to shift injury prevention away from an early, naive preoccupation with distributing educational pamphlets and posters and toward modifying the environments in which injuries occur. By developing new laws and enforcement mechanisms and through new technologies and engineering changes in products, injury experts from a broad range of disciplines sought to protect people from coming into contact with injurious amounts of energy.

This emphasis on modifying vectors and environments addressed circumstances in which it was dif-

Phase	Host (human)	Vector (vehicle)	Physical environment	Socioeconomic environment
Precrash	Driver vision Alcohol intoxication Experience and judgment Amount of travel	Brakes, tires Center of gravity Jackknife tendency Speed of travel Ease of control Load characteristics	Visibility of hazards Road curvature and gradient Surface coefficient of friction Divided highways, one-way streets Intersections, access control Signalization	Attitudes about alcohol Laws related to impaired driving Speed limits Support for injury prevention efforts
Crash	Safety belt use Osteoporosis	Speed capability Vehicle size Automatic restraints Placement, hardness, and sharpness of contact surfaces Load containment	Recovery areas Guard rails Characteristics of fixed objects Median barriers Roadside embankments Speed limits	Attitudes about safety belt use Laws about safety belt use Enforcement of child safety seat laws Motorcycle helmet use laws
Postcrash	Age Physical condition	Fuel system integrity	Emergency communication systems Distance to and quality of emergency medical services Rehabilitation programs	Support for trauma care systems Training of EMS personnel

Figure 1. The Haddon Matrix. Adapted from references 71 and 72.

ficult or impossible for an individual to prevent injury through his or her own behavior (i.e., even the most careful driver cannot reduce the potential for injury in a collison if the vehicle lacks safety belts, adequate padding, a collapsible steering column, and other protective devices). But human behavior and personal responsibility remained "undeniably important in injury causation."[21]

That view has been reinforced in recent years as psychologists and others have begun to contribute to an understanding of the behavioral and social causes of injuries.

> Within psychological domains, there are multiple origins of . . . injuries, and therefore a rich variety of prevention or intervention strategies. Researchers are beginning to examine behavioral approaches for altering children's and care givers' unsafe behavior to become safer. . . . The behavioral approach appears effective for motivating change of individuals' unsafe behaviors that may not be affected by other approaches.[22]

At this time, behavioral psychology's contribution to the prevention of injury is in its infancy, but there is much we can learn from its successful application to other health problems. Before discussing the several approaches to injury prevention in greater detail, however, it is necessary to understand that while injury is a public health problem, injury prevention cannot be solely a public health responsibility.

The Role of Public Health and the Need for Collaboration

Injury is a public health problem because of its magnitude and because of its consequences for the health of Americans. Traffic injuries alone have produced more fatalities than all the wars in which

the United States has fought, combined. No health problem responsible for so much death and disability could be defined as anything other than a public health problem. And, as we have seen, injury is a public health problem because public health methods, practitioners, and agencies can contribute to its understanding and prevention. The work of De Haven, Gordon, Gibson, Haddon, and other pioneers demonstrated that injuries could be understood with the same techniques of epidemiology that had been applied, with increasing success, to infectious diseases since the mid-19th century.[23] And, as Chapter 10 indicates, these are the very reasons why interpersonal violence and suicide are increasingly being understood as major causes of injury that must be addressed through the same methods.

Collection and analysis of data about health problems are one of the primary functions of public health agencies. By collecting and analyzing data about injuries, as is done for infectious diseases—where, when, and how they occur, and to whom—it is possible to understand patterns of occurrence, to identify risk groups for specific injuries, and to use the information as the basis for designing preventive measures. This is the foundation of the data-based approach to the design, implementation, and evaluation of prevention programs around which this book is based. Collection and analysis of data are discussed in Chapters 2 and 3; program design, implementation, and evaluation are the subjects of Chapters 4 and 5.

In addition to their data collection and analysis capabilities, public health agencies can offer practical experience in the successful management of communitywide health problems through the design, implementation, and evaluation of community-based prevention programs. And, in its recognition that health problems have multiple causes and are therefore multidisciplinary by nature, public health understands the need to coordinate and participate in fashioning multidisciplinary solutions.

Public health is only one of a number of participants—and sometimes one of the most recent arrivals—when it comes to injury prevention. If the preventability of injury is one of this book's central themes, so too is the critical need for collaboration among the many individuals and institutions whose expertise is a prerequisite for success.

Public health agencies, in particular state health departments, "have been involved sporadically over the past 50 years in childhood injury prevention and control activities."[24] However, the effort to prevent the greatest source of injury-related deaths—traffic injuries—has long been led by engineering, criminal justice, and traffic safety agencies. Preventing injuries caused by interpersonal violence and suicide was the concern of criminal justice and, more recently, of social service and mental health specialists long before public health recognized that violence could be understood through the same techniques as other sources of injury.

The point is not who got there first, but how to draw upon the expertise and the contributions each participant can make. How to foster and manage collaborative efforts are among the topics discussed in Chapters 1 and 5. It is an assumption of this book that state and local health departments can play a central role in developing or implementing injury prevention programs. It is also assumed that state and local health practitioners will participate in injury prevention efforts that begin and are housed in other departments and agencies. Where programs begin is a function of leadership, and leadership in injury prevention arises because individuals care enough to lead. A Tennessee pediatrician, an epidemiologist in the Vermont health department, two parents in California, and an Indian Health Service worker are only a few of the injury prevention leaders whose stories are told in these pages.

STRATEGIES FOR INJURY PREVENTION

Just as the occurrence of an injury requires the interaction of several factors, preventing one may require a mixture of countermeasures or interventions (the terms are used synonymously). One of the earliest attempts to systematize the process of considering injury prevention measures was Haddon's list of 10 countermeasures, mentioned earlier. Beginning in 1962, Haddon developed and refined a list of 10 general strategies designed to interfere with the energy transfer/injury process:

1. Prevent the creation of the hazard (stop producing poisons).
2. Reduce the amount of the hazard (package toxic drugs in smaller, safe amounts).
3. Prevent the release of a hazard that already exists (make bathtubs less slippery).
4. Modify the rate or spatial distribution of the hazard (require automobile air bags).
5. Separate, in time or space, the hazard from that which is to be protected (use sidewalks to separate pedestrians from automobiles).
6. Separate the hazard from that which is to be protected by a material barrier (insulate electrical cords).
7. Modify relevant basic qualities of the hazard

(make crib slat spacings too narrow to strangle a child).

8. Make what is to be protected more resistant to damage from the hazard (improve the host's physical condition through appropriate nutrition and exercise programs).

9. Begin to counter the damage already done by the hazard (provide emergency medical care).

10. Stabilize, repair, and rehabilitate the object of the damage (provide acute care and rehabilitation facilities).[20]

These 10 strategies were not intended as a formula for *choosing* countermeasures so much as an aid to thinking about them logically and systematically.

Other aids, such as PRECEDE (a diagnostic health promotion model focused on determinants of behavior change), have been developed in recent years. The PRECEDE model suggests that three types of variables should be addressed to influence health behaviors. *Predisposing* variables are antecedent to behavior and include relevant knowledge, beliefs, and values. *Enabling* variables include the availability and accessibility of personal and community resources required to perform the behavior. *Reinforcing* variables are factors subsequent to behavior that provide rewards, incentives, or punishments for continuation of the behavior. Any injury behavior may be seen as a function of the collective influence of these three factors.[25] The use of the Haddon countermeasures and the PRECEDE model in helping to design programs and select specific interventions is detailed in Chapter 4.

Interventions can be characterized as either "passive" or "active" in nature. Passive (or automatic) countermeasures require little individual action on the part of those being protected. The automobile air bag is a classic example. In a crash, the air bag automatically inflates to cushion the driver and prevent injury. Nonautomatic safety belts, on the other hand, are active interventions that require the wearer to buckle up each time to be protected. Passive measures requiring no action are often described as being "better" or "more effective" than active countermeasures.[26] Passive measures such as air bags are often difficult to implement because they require either legislative or regulatory changes directed at specific product modifications. New legislation may require educating both the public and their legislators as well as other decision makers. Look, for example, at the more than 2-decade-long battle for air bags, which are only now becoming available.[27]

Although the ideal passive measure would protect all members of the population without any action on their part, *truly* passive interventions are rare. The issue, therefore, is not allegiance to one type of intervention but the need for flexibility in combining strategies to arrive at the most effective mix.[21,28]

Intervening successfully against injuries may involve the passage and enforcement of new laws or the increased enforcement of existing laws, the education of the population at large or of targeted groups, efforts to alter specific injury-related behaviors, or changes in the design of products or of the physical environment. In this book these approaches are categorized as legislation/enforcement, education/behavior change, and engineering/technology. These are not mutually exclusive categories. The approaches can often be combined effectively. Child safety seats provide an excellent example.

Since 1978, every state has passed a law requiring that children (generally under the age of 4) riding in motor vehicles be restrained in federally approved child safety seats. These laws are interventions of the legislation/enforcement type. The seats are an engineering/technology countermeasure known to be extremely effective when used properly.[29] But the seats frequently are used incorrectly.[30] Education was an important factor in the passage of these laws and in encouraging parents to obtain and use the seats correctly. Clearly, education/behavior change interventions are critical in maintaining compliance with and thus maximizing protection from child safety seat laws.

Providing effective protection for automobile occupants, in fact, requires a mix of strategies. Developing and implementing this programmatic mix has required the combined efforts of pediatricians, public health practitioners, legislators, traffic safety specialists, educators, psychologists, public safety officials, researchers, manufacturers, parents, and other health care professionals. The best-known successes of these efforts have come through the use of legislative/enforcement and engineering/technology interventions.

Among the legislative/enforcement interventions discussed in Chapters 6–17 are increased taxes on alcoholic beverages, automobile safety belt laws, laws designed to reduce impaired driving, the Poison Prevention Packaging Act of 1970, the Children's Sleepwear Statute of 1971, smoke detector laws, and handgun control measures. Roadway countermeasures to protect pedestrians, safety belts and child safety seats, motorcycle and bicycle helmets, smoke detectors, automatic sprinkler systems, and better street lighting are among the engineering/technology countermeasures discussed.

MEMORANDUM OF AGREEMENT

By and Between

University of Maryland Baltimore
University of Maryland Medical Center
Maryland Institute for Emergency Medical Services Systems
City of Baltimore
Baltimore Police Department
and
United States Air Force Medical Service

SUBJECT: Memorandum of Agreement (MOA) between the University of Maryland Baltimore (UMB), University of Maryland Medical Center (UMMC), Maryland Institute for Emergency Medical Services Systems (MIEMSS), the Mayor and City Council of Baltimore, a municipal corporation of the State of Maryland (City), acting by and through its Health Department, the Baltimore City Police Department and the United States Air Force Medical Service (AFMS)

1. PURPOSE. This MOA is established to define and implement a Local Area Bio/Chem/Radiation Defense Demonstration and Real-time, Command and Control Update System (Demonstration). The Demonstration will test planning and preparedness for bio/chem/radiation and explosion incidents. Obligations of all parties under this MOA are subject to funding availability.

2. BACKGROUND. UMB includes among its programs and administrative units the following units which will be involved in the Demonstration: the University of Maryland School of Medicine (SOM), dedicated to providing excellence in biomedical education, basic and clinical research, quality patient care and service; which has programs including the Charles McC. Mathias, Jr., National Study Center for Trauma and Emergency Medical Systems (NSC), the primary center for research related to trauma and emergency medical systems. UMMC, the major teaching hospital affiliated with UMB, includes the R. Adams Cowley Shock Trauma Center (STC), as well as state of the art emergency medicine facilities.

   The State of Maryland is unique in that it houses the critical components to support public health in the areas of prevention, surveillance, bio-terrorism preparedness and response, at a time that our nation faces increased threats to include war. The need for communication and coordination between academic institutions, local, state agencies and federal agencies to enhance the capability of research, public health and medical response is vital. Deployment of advanced technologies as part of such response is vital to ensure that our citizens receive the best available care as needed.

3. RESPONSIBILITIES:

   a. UMB will:
      - Through the SOM, provide oversight and coordination of the academic effort;
      - Through its Environmental Health and Safety Office, provide coordination for installation, networking and testing of bio/chemical/radiation sensors, and integrate the Demonstration with the UMB emergency management plan;
      - Enable use of UMB resources (e.g., security camera images) to facilitate the Demonstration;
      - Through the NSC, serve as a focal point and integrator for all activities related to implementation of the Demonstration, provide technical system integration, and provide a real-time mobile imaging system for command and control updates
   b. MIEMSS will:
      - Participate in the Demonstration project, circumstances allowing, including the use of FRED and Rapid Response Teams.
   c. UMMC will:
      - Facilitate installation and networking of bio/chem/radiation sensors at UMMC for the Demonstration;
      - Coordinate the biological defense plan for the Demonstration with SOM researchers;
      - Integrate the Demonstration and related plans with existing UMMC disaster plans.
      - Through the STC, facilitate installation and networking of bio/chem/radiation sensors at UMMC, and participate (through the STC Rapid Response (GO Team)) in Demonstration exercises at the UMB campus and UMMC.
   d. The City, with involvement of its Health Department, Police Department, and other City services as needed, will:
      - Identify a region within the City for integration with the demonstration ;
      - Provide software and information systems for daily bio-surveillance
      - Integrate the Demonstration with existing City disaster plans.
   e. The AFMS will:
      - Coordinate expertise in bio/chem/radiation defense education and training at UMB and UMMC for the Demonstration;
      - Provide the decontamination facility for the Demonstration;
      - Identify and deploy Rapid Response Teams in Demonstration exercises at UMB and UMMC.
   f. All parties involved in the demonstration project will utilize and follow jurisdictional protocol and guidelines that have been established with respect to dissemination of emergency response information to the media and among City and State agencies and institutions.

4. EFFECTIVE DATE. This MOA will be effective upon signature of all parties.

5. TIME OF PERFORMANCE. The date(s) of the proposed Demonstration shall be mutually agreed upon by the parties

6. LIABILITIES OF GOVERNMENT PARTIES. It is understood that in the case of the government entities which are parties to this MOA, issues of liability shall be governed by applicable government tort claims acts and other applicable state and federal laws.

7. INSURANCE. The non-governmental party hereto, UMMC, shall obtain and maintain, throughout the duration of this MOA, insurance coverages, through self-insurance or through issued policies, in types and amounts acceptable to the other parties. This coverage shall provide liability coverage to UMMC and its employees. The other parties may review the UMMC insurance by making such request in writing, and UMMC will provide a certificate of its insurance or self-insurance in response to written request.

8. REVIEW. This MOA will be reviewed by the parties after six months to determine if it should be terminated.

9. TERMINATION. This MOA will terminate December 31,2004. It may be terminated sooner without cause if one or more parties gives thirty (30) days notice of termination to the other parties. This MOA may be terminated immediately when required by law or if it is deemed necessary in the interests of military mission requirements.

10. POINTS OF CONTACT.

 - -UMB: Howard Dickler, MD, as to all issues. Also, Robert Rowan MS and James Jaeger, Ph.D., as to campus administration issues; and Colin Mackenzie, MD, as to NSC issues.
 - -MIEMSS, Richard Alcorta, MD
 - -UMMC, John Ashworth, as to all issues. Also, John Spearman, MBA, as to STC issues.
 - -City, Ruth Vogel, as to all issues. Also, Peter Beilenson, MD as to matters relating to the City Health Department.
 - -AFMS, William Beninati, M.D.
 - -Baltimore City Police Department: Kevin P. Clark or designee

11. Signature. This MOA may be executed in counterparts.

12. APPROVALS.

____
David J. Ramsay Date
President, UMB

____
Donald E. Wilson, MD, MACP Date
Dean, University of Maryland School of Medicine

Robert R. Bass, MD Date
Executive Director, MIEMSS

5/6/04
John Ashworth, MHA Date
CEO, UMMC

Martin O'Malley, Mayor Date
City of Baltimore

George Peach Taylor, Jr., Lt. Gen, Date
USAF Surgeon General

Kevin P. Clark, Commissioner Date
Baltimore City Police Department

RECOMMENDATIONS:

This MOA is recommended by the following persons, representing their units:

Peter Beilenson, MD, MPH Date
Baltimore City Health Commissioner

5 7 04
Thomas Scalea, MD, Director Date
Program in Trauma
R Adams Cowley Shock Trauma Center

4/26/04
Colin F. Mackenzie, MD, Director Date
The Charles McC. Mathias National Study
Center for Trauma and Emergency Medical Services

TABLE TOP EXERCISE SCENARIO

TIME	INJECT	EXPECTED REACTION	OBJECTIVE
0000	Sensor activated at loading Dock	Campus Police & EHS Respond to Investigation	1. Test Campus Police Reaction 2. Test communication between Campus Police & EHS. 3. Determine appropriation of procedures.
0010	Call to Campus President Office "Bomb" on Campus	711 Contacted Campus Police call 911	1. Communication between Campus Police & UMMC 2. UMMC reaction? a. Evacuate vs. Stay in Place b. Lock down & notification to EMS
0015	911 Arrives Media-calls	911 Gathering Info from Campus Police & EHS	1. Communication Campus Police & 911 (BCPD)
0030	Media arrives (call police department) to ask where the emergency is. EMD-Decon Facility set-up needed		Test 1) Lead Spokesperson 2) Joint Information Center 3) Plans to Deal with media
0035	2 Ambulance arrives at ED	Request MIEMSS for ED to go on Mini Disaster	Communication with EMS/SYSCOM
0040	Call from SYSCOM 3 min. ETA Helicopter	Request MIEMSS for Shock Trauma to go on Trauma By Pass	Test ability to go on Trauma bypass
0045	Attempted detonation fails	Secure – Periphery, Arrest Bomber Defuse – Bomb Contain Radioactivity (iridium)	Test 1) Crowd control 2) Bomb squad operation 3) Radioactivity management 4) Law enforcement

TIME	INJECT	EXPECTED REACTION	OBJECTIVE
0050	Email Campus server goes down	IT emergency response	1) Test back-up procedures.
0060	Synthesis of Plan	Each Spokesperson from Campus, Hospital, City and any other entities will present summary	2) Allow consensus among participants 3) Identify strengths, weakness opportunities and threats to effective Emergency Response

EVALUATION OF THE TABLE TOP EXERCISE, FEBRUARY 27, 2004
(THE EXERCISE)

Please return completed form to Registration table at the Terrace Lounge Entrance or simply leave at your assigned table. – *Thanks for your help!*

I am from (check) ☐ State ☐ City ☐ UM Campus ☐ Military ☐ Other: ______________________

Please circle the appropriate number 1-5 for your response to the questions below.

1 *Strongly Disagree*	2 *Disagree*	3 *Don't Agree or Disagree*	4 *Agree*	5 *Strongly Agree*

1. The scenario was realistic.	1	2	3	4	5
2. The Exercise helped me prepare for a similar real event.	1	2	3	4	5
3. The Campus/City emergency coordination was increased by the Exercise.	1	2	3	4	5
4. For me, the Exercise revealed the following about the Emergency Management Plan (EMP)					
a) My knowledge of the UM EMP	1	2	3	4	5
b) Ease of Inter-Campus Communications	1	2	3	4	5
c) Importance of coordination of Campus EMP with outside agencies.	1	2	3	4	5
d) Need for early involvement of City in Campus EMP.	1	2	3	4	5
e) Confidence in decision about how to manage Scenario.	1	2	3	4	5
f) Identified how I can help the Campus EMP	1	2	3	4	5
g) Improved my understanding of how events change rapidly.	1	2	3	4	5
h) Showed me the need for media communication strategy.	1	2	3	4	5
i) Revealed a requirement for a single spokesperson.	1	2	3	4	5
j) Importance of control of the "Walking Worried".	1	2	3	4	5
k) Showed an integrated response between Campus/City/State Emergency Responders	1	2	3	4	5
l) Maximum use of Campus Resources	1	2	3	4	5

List 3 strengths of the Exercise:

1.______________________________

2.______________________________

3.______________________________

List 3 weaknesses of the Exercise:

1.______________________________

2.______________________________

3.______________________________

What opportunities did you see for an improved emergency response?

____

____

____

What threats did you see to a coordinated emergency response?

____

____

____

Table Top Exercise Group Assignments

Speakers
Ron Poropatich
Dennis Schrader

Table 1 – Facilitators
Edward Ballard
Cleveland Barnes
John Donohue
Jon Mark Hirshon
James Jaeger
Colin Mackenzie
Linda Pelletier
Pat Tate

Table 2 – Campus
Robert Rowan (Group Leader)
Robert Barish
Karyn Bergmann
Carrie Burmaster
Paul Drehoff
Ed Fishel
Michael Greenberger
David Hartley
Matt Larson
John Magness
Bill McMahon
William Morgan
Larry Roberts
Greg Sackett
Ron Sappington
Daryll Smith

Table 3 – UMMC
John Spearman (Group Leader)
Christine Goatee
Linda Hines
Mary Nelson
Connie Noll
Wayne Peters
John Preto (Alternate Group Leader)
Shahada Riley
Bill Seiler or Ellen Beth Levitt
Roger Shere-Wolfe
Hal Standiford or Joan Hebden
Jim Wires

Table 4 – Baltimore City
Kenneth Hyde (Group Leader)
Edward Arnold
Major Engel
Kathy Forrester
John Links
George McClaskey
Charles Schneider
Christa Singleton
Major Skinner
Laurie Zurmoski

Table 5 – State
Al Romanosky/Clay Stamp (Group Leader)
Bruce Anderson
Julie Casani
Renee Fetcher
David Fowler
Jim Gelata
James Grove
Carl Phelps
Jim Radcliffe
Jack Titus
Grace Zaczek
Dawn Zolaf

Table 6 – Observers
Jerry Stockton(Group Leader)
Nabil Anis
William Beninati
Ken Benson
Willie Bido
Daniel Bochicchio
Clark DuCharme
Tim Ganous
Ed Kensinger
Kyle Martin
Bill McMahon
Alex Menkes
Claudia Oglivie
Robin Rossiter

Notes: F. Jacob Seagull and Yan Xiao
Video: Steven Seebode

Administration: Ginny Goble, Diane Harris, Erica London, Tamas Gal and David Overturf

LAD DEMONSTRATION EXERCISE

March 26, 2004

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
9:45 a.m.	Controller Team (CT)		Bomber in campus maintenance uniform enters MIEMSS Bldg.	Start Exercise; bomber plants a clean bomb (Bomb #1) on roof of MIEMSS Bldg; dirty bomb (Bomb #2) placed at loading dock at UMMC.	
10:00 a.m.	Controller Team (CT)	Radiation Safety (RS) CP/EHS/CT	RS takes radiation source to activate sensors. Sensors send alert via phone line to Campus Police (CP), EHS and CT	Radiation sensor near loading dock at UMMC triggers.	Test radiation sensor detection and transmissions of telephone alert system to CP/EHS/CT.
10:00-10:15 a.m.	CP / EHS / CT	Environmental Health and Safety (EHS)	Phone 6-7055 Ask CP to page EHS	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with EHS and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm?
	EHS	CP	711	EHS informs CP that the radiation is coming from a suspicious source.	Test internal notification of problem and detection of radiation threat. Test adequacy of training and equipment to find source of radiation and differentiate it from medical isotopes. Did RS locate suspicious source and inform CP?
	CP	Campus Emergency Management Director (EMD); UMMC Administrator on Call (AOC)	Phone	CP inform EMD of the presence of the potential problem at UMMC, and review video surveillance images of the area around the radiation sensor.	Test communication with EMD. Test whether CP use video surveillance camera review. Did RS respond promptly? Did RS have appropriate instrumentation?
10:20 a.m.	EMD; AOC	Campus Emergency Management Team (UMB EMT) and Hospital Emergency Management Team (UMMC EMT)	Phone/Radio Internet	EMD and AOC alert UMB EMT and UMMC EMT of potential crisis. They may convene their respective teams at the Pearl Street Garage Operations Center (PSGOC) and the hospital.	Determine UMB and UMMC EMT responsiveness, if activated.
10:20 a.m.	EHS	Baltimore City Health Dept. (BCHD); MD Poison Center (MPC)	Phone	EHS alerts CP; CP alerts EMD (and possibly AOC -- Cleveland Barnes can answer that?)	Test communication with local authorities.
10:25 a.m.	EHS	CP; EMD; AOC	Phone, Radio and Internet	Determines that a significant source of radiation at UMMC is coming from a briefcase left on the loading dock. EHS alerts CP, EMD and AOC. EHS suggests secure 300 feet perimeter.	Assess EHS ability to determine that the radiation source is suspicious. Test whether RS has correct sensors to detect isotope.
	CP	BCFD and BCPD	Phone 911 and Radio	CP requests assistance from the BCFD and BCPD with suspicious radiation source.	Test communication with local authorities and EHS.
	CP	Officers on Duty	Phone/Radio	CP secures 300 square foot area around the radiation source.	Assess effectiveness of CP as initial incident commanders.
	EMD; AOC	UMB EMT and UMMC EMT	Phone, Radio	EMD and AOC alert respective teams that the there is a suspicous source at the UMMC loading dock. EMTs convene, if not already assembled.	Test communication with UMB and UMMC EMTs. Test collaboration between CP and UMB EMT on implementation of the Campus Emergency Management Plan.

LAD DEMONSTRATION EXERCISE

March 26, 2004

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
10:30 a.m.	EMD	President's Office	Phone/radio	Information about suspcisous radiation source	Test EMD Communications.
	UMMC EMT	Shock Trauma Center (STC) and Emergency Dept. (ED)	Phone/radio	UMMC EMT informs STC and ED of situation. ED goes on by-pass. STC goes on fly-by.	Test coordination between the UMMC EMT and hospital units.
10:30 a.m.	CP	BCFD	Phone 911	BCFD arrives on Campus.	Hand over of Incident Comand CP - BCFD.
10:30 a.m.	CT	BCFD	Inject #1 on Scene Campus Video acess Tablet	Video surveillance Tablet review	Review Historic Data of radiatioin sensor alarm triggering event and determine when suitcase planted.
10:45 a.m.	Media	OEA President's Office	Phone	Bomber alerts the media as to the presence of both bombs: dirty bomb at UMMC and clean bomb at MIEMSS (set to explode around 11:45 a.m.)	Inform BCFD that 2 bombs.
	BCFD	BCFD	Radio	Request Bomb Squad for 2nd Bomb at MIEMSS	Test access to Bomb Squad and additional responses.
	OEA	EMD; AOC; CP	Phone/radio	OEA alerts EMD, AOC and CP of the bomber's threat.	Assess OEA response and ability to disseminate this information quickly.
10:50 a.m.	IC (BCFD)	EMD, AOC and MIEMSS	Phone/radio	CP recommends that the MIEMSS building be evacuated.	Test communications between CP, AOC, MIEMSS, and the EMD.
	MIEMSS Management	MIEMSS staff	Alarm; Phone	Orders evacuation of the MIEMSS building	Test building evacuation plan.
	BCFD	BCFD	Radio	Notificationof 2nd Team at MIEMSS	Test communication and set up of 2nd IC site at MIEMSS
	EMD/CP	BCFD	Radio	Establish communication between BCFD and Campus Based EM Teams	Test Unified Command
	BCFD	MEMA/DHMH	Phone	BCFD brings in State Agencies	Test whether ask for State help.
	EMD	CP UMB EMT UMMC EMT MIEMSS EMT	Discussion Group at PSGOC	Decide on whether to implement shelter-in-place or to evacuate entire campus.	Test EMT decision process for shelter-in-place or evacuation.
10:55 a.m.	EMD	President Ramsey; Deans	Phone	UMB EMT alerts President Ramsey and the dean of each school and makes a recommendation on whether to evacuate the entire campus.	Test communications between UMB EMT and school officials and BCFD.

LAD DEMONSTRATION EXERCISE

March 26, 2004

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
	CP	VAMHCS, FRED/MIEMSS	Phone & Radio	CP establishes perimeter limits traffice access to and egress from UMMC and MIEMSS	Test CP ability to control crowd and traffic.
	UMMC AOC	UMMC EMT	Phone & Radio	UMMC sets up incident command using HEICS	Test effectiveness of UMMC incident command establishment and HEICS implementation.
11:00 a.m.	UMB EMT	Campus Community	Internet; Voice Mail	UMB EMT places a notice on campus website and sends email to the Campus President, VPs and Deans along with an email to SIP Coordinators and Fire Wardens.	Test UMB EMT communication to campus community and, depending on whether the campus is evacuated or not, campus shelter-in-place and exit control procedures.
	UMB EMT	Campus Counseling Center (CCC)	Phone	UMB EMT alerts CCC of situation and CCC deploys counselors to an assembly point designated by the UMB EMT.	Assess the response of the CCC. Test identification and establishment of a safe haven.
	BCFD; BCPD	CP	On scene video surveillance tablet review incident	BCFD and BCPD officers review video surveillance tapes covering MIEMSS building and UMMC.	Assess usefulness of historic video data review for situational awareness and bomb detection.
	BCPD	IC (BCFD)	Incident Command	BCPD working with BCFD and CP set up an incident command center and initiate crime scene investigation.	Test ability to establish unified command communications and incident command center at UMB in an expedient manner.
11:05 a.m.	Media; general public; UMB students & staff	Incident Commander EHS		The media descends on UMB campus; several panic-stricken individuals ("worried well") arrive at MIEMSS and UMMC and are creating havoc.	Determine ability of IC to control situation and stem panic. Are appropriate EHS staff and BCFD experts available to consult if requested?
	IC	ED	Phone / Radio	Casualty at MIEMSS - chest pains during evacuation	Test whether ED accepts despite fly-by.
	Incident Commander (IC)	EMD; AOC	Phone / Radio	IC informs EMD of the media's presence and asks for a press statement/location for briefing; IC asks if there is a location for worried well to go to get information; IC informs EMD and AOC of casualty at MIEMSS; EMD instructs IC to direct "worried well" to CCC assembly area.	Determine effectiveness of direction of worried well to safe haven. Are appropriate EHS staff and BCFD experts available to consult of requested?
	EMD	OEA	Phone	EMD asks OEA to prepare a press release and to determine a location and time for a press conference.	Test collaborative process and ability of OEA to control information flow to media. Are appropriate EHS staff and BCFD experts avaialble to consult if requested?
11:15 a.m.	OEA	IC	Phone / Radio	OEA instructs IC on location and time of press conference	Information control to reduce panie

LAD DEMONSTRATION EXERCISE

March 26, 2004

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
	OEA	Campus and Media	Internet; phone	OEA prepares and posts a statement on the campus website and contacts media.	Test OEA/media relations' ability to present a unified voice for the campus. Evaluate message content.
11:20 a.m.	BCPD	On duty officer FBI	Radio	After review of video tapes and investigation of building, BCFD and BCPD confirm presence of two potential bombs and obtain description of suspect. Alert FBI.	Assess usefulness of historic video data review for situational awareness and bomb detection.
11:20 a.m.	BCFD	UMMD/STC	Radio/Phone	implementation of management plan for potential radiological casualties	Test set up and staffing of decontamination facility. Are appropriate EHS and BCFD experts available to consult if requested?
11:30 a.m.	MEMA	IC	Radio	Arrives on Campus to provide assistance with Dirty Bomb.	Threat analysis of Dirty Bomb management.
11:30 a.m.	BCHD; DHMH MEMA	IC	Phone/Radio/Page	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Test implementation of plan for potential radiological casualty management.
11:40 a.m.			Set up Decon Facility	Set-up facility for decontamination of potential radiation victims.	Test decontamination facility set-up
Inject #4	CT	All	Suspected Dirty Bomber Apprehend at BWI		
	BCPD	IC	Radio/Phone	Informs IC that BCPD has apprehended suspected "Dirty Bomber" and is interrogating him for further information.	
11:45 a.m.				Clean bomb (Bomb #1) explodes and destroys SYSCOM	
11:50 a.m.	Emergency Medical Technicians (EMTs); BCFD		Radio	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Test emergency response to explosion. Test effectiveness of communication.
12:05 p.m.	IC	OCME	Phone	IC informs OCME of the explosion and reports three fatalities; OCME arrives on the scene shortly after.	Test prolonged extrication abilities and management of the deceased.
12:10 p.m.	IC	UMMC / STC / VAMHS	SYSCOM / FRED / Phone	IC requests bed availability status.	Test Resource Access.
	IC	VAMHCS, MEMA / FRED	Phone	EMD gives status report.	Test effectiveness of SYSCOM backup after occurrence of bomb damage.
	IC	FM	Radio / Phone	IC informs EMT and EMT should send a team from FM to investigate the damage and restore systems where possible.	Test response capabilities of FM
1:00 p.m.	BCFD			Bomb squad defuses dirty bomb (Bomb #2).	Test ability to handle and defuse radioactive bombs.
1:10 p.m.	IC		Radio	IC implements process for normalization.	Test ability to resume normal operations in an efficient and expedient manner.
2:00 p.m.	CT	All	Radio	Demonstration Ends	

LAD DEMONSTRATION EXERCISE

March 26, 2004

Individual UMB Division/Department Objectives Tested:

(Examples are illustrative and not all inclusive)

All:	Test ability to have division/department keep EMT informed (through their staff representative on the EMT) and to get information from the EMT (through their staff representative).
CCC:	Test Campus Counseling Center's ability to set up Crises Information Centers and provide information to concerned staff, students, visitors and others.
CP:	Test their response to suspicious package, radiation etc. Test their ability to contain/isolate an area of campus. Test their Incident Command ability as they take charge of the area and later serve as part of a unified command at the scene.
EHS:	Test their response to unknown radiation source. Test their ability to advise EMT on specific radiation risk assessment. Test their ability to advise and assist other emergency responders as needed.
FM:	Test ability to isolate building(s) for Shelter-In-Place.
OCME:	Test Internal Plan for managing the dead.

LIST OF ACRONYMS

AOC	Administrator on Call for hospital
BCFD	Baltimore City Fire Department
BCHD	Baltimore City Health Department
BCPD	Baltimore City Police Department
CCC	Campus Counseling Center
CP	Campus Police
CT	Controller Team
DHMH	Maryland Department of Health and Mental Hygiene
ED	Emergency Department for UMMC
EHS	Environmental Health and Safety
EMD	UMB Campus Emergency Management Director
EMTs	Emergency Medical Technicians
FM	Facilities Management
FRED	Facilities Resource Emergency Database
HEICS	Hospital Emergency Incident Command System
IC	Incident Commander
MEMA	Maryland Emergency Management Agency
MIEMSS	Maryland Institute of Emergency Medical Services Systems
MPC	Maryland Poison Center
OCME	Office of the Chief Medical Examiner
OEA	Office of External Affairs (Media Relations)
PSGOC	Pearl Street Garage Operations Center
RS	Radiation Safety
STC	Shock Trauma Center
UMB	University of Maryland, Baltimore
UMMC	University of Maryland Medical Center
UMMS	University of Maryland Medical System
UMB EMT	Campus (UMB) Emergency Management Team
UMMC EMT	Emergency Management Team for UMMC
USAF	United States Air Force
VAMHCS	Veterans Administration Maryland Health Care System

LAD DEMONSTRATION CONTROLLER TEAM (CT)

Time	Inject	Expected Reaction	Objective
10:30 a.m.	#1 Portable video surveillance access tablet delivered to BCFD (IC) with assistant to operate.	IC will use this video tablet on scene to access cameras overlooking scene and (later) overlooking MIEMSS.	1) Test IC reaction; 2) Identify whether they review historic surveillance camera data when sensor triggered. 3) Assess whether this video data increases situational awareness.
10:45 a.m.	#2 Newsperson calls President's Office to convey information that bomber has planted 2 bombs on campus, one in the MIEMSS Building set to explode at 11:45 am	President's Office will have been informed by EMD of suspicious radiation source and will tell CP that have received a call about 2 bombs. Will put media in contact with OEA.	1) Test how media message gets conveyed to campus; 2) Evaluate how campus media keeps information flowing to city media.
11:05 a.m.	#3 Call for VA cache for Trauma Care	IC will contact VAMC.	1) Assess ability of VAMC to release cache; 2) Test whether VAMC can get cache across to UMMC.
11:30 a.m.	#4 Evacuate OCME because of bomb at MIEMSS.	Evacuate OCME to alternative site? Anatomy Board? Police Barracks?	1) Test decision making about OCME; 2) Determine whether they go to Anatomy Board or Police Barracks..
11:40 a.m.	#5 Suspected "Dirty Bomb" is apprehended at BWI Airport on basis of video surveillance generated description.	BCPD/FBI will start questioning the suspect.	1) Determine whether FBI/BCPD liaison works; 2) Determine how they convey interrogation information to IC.
11:45 a.m.	#6 Bomb explodes at MIEMSS -- destroys SYSCOM and kills 3 BCFD personnel/Alternative: Bomb Squad defuses bomb before explosion	1) Move SYSCOM to back-up system; 2) Call OCME for managing the dead; 3) Consider OCME evacuation.	1) Test the SYSCOM back-up communication; 2) Test OCME fatality management.
1:00 p.m.	#7 Bomb Squad contains "Dirty Bomb" and defuses it.	1) Signals threat reduction and start of restoration of operations.	Test how plans to implement normalization are implemented.

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
9:45 a.m.	CT	Start Exercise; bomber plants a clean bomb (Bomb #1) on roof of MIEMSS Bldg; dirty bomb (Bomb #2) placed at loading dock at UMMC.	Was bomber observed?				
10:00 a.m.	CT	Radiation sensor near loading dock at UMMC triggers.	Test radiation sensor detection of "dirty bomb" made from stolen cesium and transmissions of telephone alert system to CP/EHS/CT. Did sensors alert to detection of Rad?				

ATTACHMENT #6B – Evaluation of LAD – Overall Plan

Summary of All Units

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	AOC	UMMC sets up incident command using HEICS	Was UMMC incident command established? Was Heics implemented?				
10:00-10:30 a.m.	BCFD	Alert MIEMSS of bomb placement	Did IC comtact MIEMSS about bomb?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	BCFD (Sector 1)	Request Bomb Squad for 2nd Bomb at MIEMSS	Was bomb squad contacted?				
10:00-10:30 a.m.	CP	CP requests assistance from the BCFD and BCPD with suspicious radiation source.	Did CP contact a) BCFD; b) BCPD; c) EHS about radiation?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP	CP inform EMD of the presence of the potential problem at UMMC, and review video surveillance images of the area around the radiation sensor.	a) Did CP communicate with EMD? B) Did CP use video surveillance camera? C) Did RS respond promptly? D) Did RS have appropriate instrumentation?				
10:00-10:30 a.m.	CP	CP secures 300 square foot area around the radiation source.	Were CP effective as initial incident commanders?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP	BCFD arrives on Campus.	Did hand over of Incident Comand CP - BCFD go smoothly?				Assess effectiveness of establilshment police control? Worst 1 2 3 4 5 Best
10:00-10:30 a.m.	CP	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	a) Did EHS and investigation of radiation sensor alarm go expeditiously? b) Did the auto dial work? c) Did EHS and CP notify each other of sensor alarm?				
10:00-10:30 a.m.	CP	Establish communication between BCFD and Campus Based EM Teams	Unified Command Communications				Unified Command Communications Worst 2 3 4 5 Best

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP and/or EMD	Inform UMMC of potential problem	Communication between UMB and UMMC				Communication between UMB and UMMC Worst 1 2 3 4 5 Best
10:00-10:30 a.m.	CT	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with EHS and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm?				
10:00-10:30 a.m.	EHS	EHS tells CP they will investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with CP and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm? What method of communication was used?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	EHS	EHS informs CP that the radiation is coming from a suspicious source.	Test internal notification of problem and detection of radiation threat. Test adequacy of training and equipment to find source of radiation and differentiate it from medical isotopes. Did RS locate suspicious source and inform CP? Who notifies who?				
10:00-10:30 a.m.	EHS	Determines that a significant source of radiation at UMMC is coming from a briefcase left on the loading dock. EHS alerts CP. EHS suggests secure 300 feet perimeter.	Assess EHS ability to determine that the radiation source is suspicious. Test whether RS has correct sensors to detect isotope.				
10:00-10:30 a.m.	EMD	EMD alerts UMB EMT of potential crisis. He may convene at the Pearl Street Garage Operations Center (PSGOC).	How was UMB EMT responsiveness, when activated. Who curtails current operation to establish contingency operations?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	EMD	Establish communication between BCFD and Campus Based EM Teams	Were Unified Command Communications effective? What is primary communication mode? What is the backup plan?				
10:00-10:30 a.m.	EMD and/or CP	Inform UMMC of potential problem. Is the potential problem identified? Who at UMMC is notified?	Was this communication between UMB and UMMC?				
10:00-10:30 a.m.	EMD and/or CP	Inform UMMC of potential problem	Test communication between UMB and UMMC.				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	Hospital Security	Inform UMMC of potential problem	Who notifies who? What is the trigger for notification?				
10:00-10:30 a.m.	MIEMSS	Informs MEMA of situation	Tests notification of State Agencies --POC list --- Order notified --- Lost time list updated --- Is it complete?				
10:00-10:30 a.m.	OEA on-site media rep	news media have started arriving at BCFD command post and requesting information	Assess UMB-EMT response to external media needs for information --- Prepare statement --- Secure area for media				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	OEA/media reps	OEA alerts EMD, AOC and CP of the bomber's threat.	Assess OEA response and ability to disseminate this information quickly. --- Media notification plan				
10:00-10:30 a.m.	UMB EMT	EMD gives Information about suspicious radiation source	Test EMD Communications. --- Primary/alternate communications --- Notification roster --- Who initiates				
10:00-10:30 a.m.	UMB EMT	EMT alerts campus about the situation and road closings	Assess EMT response and ability to disseminate this information quickly.--- Mode of communications and backup --- Notification roster --- Is OEA on it? --- Alternate routes given for emergency vehicles				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	UMMC EMT	UMMC EMT informs STC and ED of situation. ED goes on mini-disaster STC goes on fly-by.	Test coordination between the UMMC EMT and hospital units. --- Was EMP followed? --- Notification roster --- Primary/back-up communications				
10:00-10:30 a.m.	WJZ	Alert IC of threat by Bomber	Test communication flow and response to information. --- Notification chain --- Verification of incident --- Coordinate joint press release				
10:00-10:30 a.m. Inject 1	CT	Review Historic Data of radiation sensor alarm triggering event and determine when suitcase planted.	Was viability of on-site video tape review possible? Did review of surveillance video occur?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:45 a.m. Inject 2	Bomber	Bomber alerts the media as to the presence of both bombs: dirty bomb at UMMC and clean bomb at MIEMSS (set to explode around 11:45 a.m.)	Inform BCFD/BCPD that 2 bombs.				
10:50 a.m.	BCFD	Notification of 2nd sector at MIEMSS	Did BCFD set up 2nd sector at MIEMSS?				
10:50 a.m.	BCFD	BCFD alerts State Agencies and request assistance	Was help requested from State agencies?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	BCFD	Establishment of a wider perimeter which limits traffic access to and egress from UMMC and MIEMSS	a) Was perimeter established? B) Was traffic controlled? C) Was crowd controlled?				
10:50 a.m.	BCPD	Establishment of a wider perimeter which limits traffic access to and egress from UMMC and MIEMSS	Was BCPD able to control crowd and traffic?				
10:50 a.m.	Experts - BCPD, BCFD, FBI	Assess need for larger evacuation	Was magnitude of event gauged correctly? Are there default plans from BCFD on such an event? Can RS determine type of isotope to rule out neclear detonation? Can BCFD/BCPD determine "worst-case" scenario for dirty bomb based on size of suitcase? Can BCFD/BCPD contain the blast to reduce contamination?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	IC	Determines level of event and decides course of action conerning public safety	Were decision making capabilities of IC and decision implementation adequate?-- EMP available?				
10:50 a.m.	IC	Enlarge evacuation (if deemed appropraite)	Communication between IC and multple agencies -- Copy of POC list --- Order they are called				Communication between CP and IC 1 2 3 4 5
10:50 a.m.	IC (BCFD)	Orders evacuation of the MIEMSS building	Evac plan -- who initiates; Were floor fire wardens notified; Rally points identified; Personnel accountability				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	IC (BCFD), joint with UMB EMT	IC recommends that the MIEMSS building be evacuated.	Communications between CP, IC of UMMC, MIEMSS, and the EMD. Copy of POC list available and instructions				
10:50 a.m.	MIEMSS Management	Orders evacuation of the MIEMSS building	Test building evacuation plan. -- Who initiates? --- Floor fire wardens notified --- Rally points identified --- Personnel accountability				
10:50 a.m.	UMB joint with EMT IC (BCFD)	IC recommends that the MIEMSS building be evacuated.	Test communications between CP, IC of UMMC, MIEMSS, and the EMD. ---Copy of POC list and instructions -- Primary and secondary modes of communication				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:00 a.m.	BCPD	BCFD and BCPD officers review video surveillance tapes covering MIEMSS building and UMMC.	Was historic video data review used for situational awareness and bomb detection?				
11:00 a.m.	BCPD	BCPD working with BCFD & CP set up an incident command center and initiate crime scene investigation.	Was a functional unified command communications established?				
11:00 a.m.	UMB EMT	UMB EMT alerts CCC of situation and CCC deploys counselors to an assembly point designated by the UMB EMT.	Assess the response of the CCC. Test identification and establishment of a safe haven.-- How notified -- Information given including route to scene				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:00 a.m.	UMB EMT	UMB-EMT/CP updates campus on 2nd emergency at MIEMSS and possible evacuation of SON or garage	Test communication with fire marshalls and ability of the UMB-EMT to update the campus information rapidly --- Notification Roster --- Primary/Alternate comunications				
11:05 a.m.	EMD	EMD asks OEA to prepare a statement and to determine a location and time for a briefing.	Did OEA control information flow to media. Are appropriate EHS staff and BCFD experts avaialble to consult if requested? Should the unified command be the ONLY source for information?				
11:05 a.m.	General public; UMB students & staff	Public descends on UMB campus; several panic-stricken individuals ("worried well") arrive at UMMC and are creating havoc.	Was IC able to control situation and stem pani?. Has the IC managed expectations by releasing information that minimizes the effect that rumors will generate? Have the media been responsible in the reporting of the event as it unfolds? Is there a plan to care for panic-stricken patients by isolating them from the public at large?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:20 a.m.	BCFD	Implementation of management plan for potential radiological casualties	Was an alternative site for Decon establishe?Were appropriate EHS and BCFD experts available to consult?				
11:20 a.m.	BCPD	After review of video tapes and investigation of building, BCFD and BCPD confirm presence of two potential bombs and obtain description of suspect. Alert FBI.	Was historic video data review used for situational awareness and bomb detection?				
11:20 a.m.	Media reps	OEA instructs IC on location and time of briefing	Information control to reduce panie -- Prepared statement --- Secure area for press --- Time of updates				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:20 a.m.	Media Reps	OEA prepares and posts a statement on the campus website and contacts media.	Test OEA/media relations' ability to present a unified voice for the campus. Evaluate message content. --- Timeliness of message				
11:20 a.m.	UMB EMT	UMB EMT gives updated information to media reps on-site with news media	Test EMT's ability to deliver timely information to avoid panic -- Coordinate w/OEA --- Verify info				
11:30 a.m.	BCHD	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Was a plan developed for potential radiological casualty management?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:30 a.m.	DHMH	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Did plan for potential radiological casualty management get determined? Was plan available? Which plan used -- Local___ State___ Who decided to implement radiological plan? Local ___ State____				
11:30 a.m.	MEMA	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Test implementation of plan for potential radiological casualty management.				
11:30 a.m.	MEMA	Arrives on Campus to provide assistance with Dirty Bomb.	Threat analysis of Dirty Bomb management. -- Hotzone established --- Initial test --- NRC involved --- Federal Agencies notified -- Evacuation of building in the immediate area				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:40 a.m.	BCPD	Informs IC that BCPD has apprehended suspected "Dirty Bomber" and is interrogating him for further information.	Was this information communicated to other agencies?				
11:40 a.m.		Set-up facility for decontamination of potential radiation victims.	Test decontamination facility set-up				
11:40 am Inject #3	CT	--	--				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:45 a.m.	OEA on-site media rep	News media ask for updated information to prepare for Noon newscasts	Test ability of UMB EMT to provide timely information for news media --- Established times for update				
11:45 a.m. Inject #4		Clean bomb (Bomb #1) explodes and destroys SYSCOM					
11:50 a.m.	BCFD	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Was explosion response coordinated?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:50 a.m.	Emergency Medical Technicians (EMTs)	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Was emergency response to explosion effective? Test effectiveness of communication.				
12:05 p.m.	IC	IC informs OCME of the explosion and reports three fatalities; OCME arrives on the scene shortly after.	Were prolonged extrication abilities and management of the deceased adequate. -- Press release --- Evac plan --- Mortuary affairs				
12:10 p.m.	IC	IC requests bed availability status.	Test Resource Access. --- Phone # to PAD --- Bed status by type				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
12:10 p.m.	IC	EMD gives status report.	Test effectiveness of SYSCOM backup after occurrence of bomb damage. --- Users trained				
12:15 p.m.	UMB EMT	UMB EMT provides updated information to the campus community on the changing situation	Test ability of the UMB EMT to provide timely updated information to the campus -- Established times for updates				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
12:45 p.m.	IC	IC informs FM of damage to MIEMSS building; FM sends staff to MIEMSS to assess damage and restore systems where possible.	Test response capabilities of FM --- How notified --- Information given, including route to scene				
12:45 p.m.	OEA on-site media rep	News media need updated information for 1pm newscasts	Test ability of the UMB EMT to provide timely updated information for news media--- Principle POC in IC for info --- Times IC POC				
1:00 p.m.	BCFD	Bomb squad defuses dirty bomb (Bomb #2).	Test ability to handle and defuse radioactive bombs. Were necessary precautions taken to defuse?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
1:10 p.m.	IC	IC implements process for normalization.	Were normal operations resumed in an efficient and expedient manner? --- Disengagement plan				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
1:15 p.m.	OEA on-site media rep	News media ask for University official to go news conference/interviews about UMB recovery	Test ability of UMB EMT to provide an official to speak for the University--- University spsokesman identified early on --- Who in OEA is giving them info --- Single POC for info flow to spokesman				
2:00 p.m.	CT	Demonstration Ends	--				

10 RECOMMENDATIONS OF LAD TABLE TOP: AFTER ACTION DEBRIEF

1) Simplify Campus Emergency Management (EM) Response Plan – Operational Portion
2) Consolidation Emergency Operations Centers (EOC's) (all campus EOC's at single site)
3) Communication Exercise
   a) Campus Internal
   b) Off-Campus
4) Review & Analysis of UM Campus EM Response Plan with UM Medical Center, VA Medical Center, BCFD, etc.
5) More Inclusive of Veterans Administration (VA) resources and VA Emergency caches.
6) Make EM Response Plans of Campus and Hospitals more accessible and coordinated.
7) Clarify the evacuation/shelter-in-place policy and procedures.
8) Allow 2nd in command to be in charge for Exercises.
9) In real emergency make optimum use of Maryland Emergency Management Agency (MEMA) personnel to assist hazard mitigation and evacuation.
10) Write-up UM Campus Exercise as model system – promote Maryland expertise.

LAD DEMO

EXERCISE

March 26, 2004

Charles McC. Mathias, Jr.
National Study Center
for Trauma and Emergency Medical Systems

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Notes

1

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
9:45 a.m.	Controller Team (CT)		Bomber in campus maintenance uniform enters MIEMSS Bldg.	Start Exercise; bomber plants a clean bomb (Bomb #1) on roof of MIEMSS Bldg; dirty bomb (Bomb #2) placed at loading dock at UMMC.	
10:00 a.m.	Controller Team (CT)	Radiation Safety (RS) CP/EHS/CT	RS takes radiation source to activate sensors. Sensors send alert via phone line to Campus Police (CP), EHS and CT	Radiation sensor near loading dock at UMMC triggers.	Test radiation sensor detection of "dirty bomb" made from stolen cesium and transmissions of telephone alert system to CP/EHS/CT.
10:00-10:30 a.m.	CP / EHS / CT	Environmental Health and Safety (EHS)	Phone 6-7055 Ask CP to page EHS	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with EHS and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm?
10:00-10:30 a.m.	EHS	CP	711	EHS informs CP that the radiation is coming from a suspicious source.	Test internal notification of problem and detection of radiation threat. Test adequacy of training and equipment to find source of radiation and differentiate it from medical isotopes. Did RS locate suspicious source and inform CP?
10:00-10:30 a.m.	CP	BCFD and BCPD	Phone 911 and Radio	CP requests assistance from the BCFD and BCPD with suspicious radiation source.	Test communication with local authorities and EHS.
10:00-10:30 a.m.	CP	Campus Emergency Management Director (EMD)	Phone	CP inform EMD of the presence of the potential problem at UMMC, and review video surveillance images of the area around the radiation sensor.	Test communication with EMD. Test whether CP uses video surveillance camera. Did RS respond promptly? Did RS have appropriate instrumentation?
10:00-10:30 a.m.	EMD and/or CP	Hospital Security	Phone	Inform UMMC of potential problem	Test communication between UMB and UMMC.
10:00-10:30 a.m.	Hospital Security	AOC	Phone	Inform UMMC of potential problem	
10:00-10:30 a.m.	EMD	Campus Emergency Management Team (UMB EMT)	Phone/Radio Internet	EMD alerts UMB EMT of potential crisis. He may convene at the Pearl Street Garage Operations Center (PSGOC).	Determine UMB EMT responsiveness, if activated.
10:00-10:30 a.m.	AOC	UMMC EMT	Phone & Radio	UMMC sets up incident command using HEICS	Test effectiveness of UMMC incident command establishment and HEICS implementation.
10:00-10:30 a.m.	EHS	CP	Phone	Determines that a significant source of radiation at UMMC is coming from a briefcase left on the loading dock. EHS alerts CP. EHS suggests secure 300 feet perimeter.	Assess EHS ability to determine that the radiation source is suspicious. Test whether RS has correct sensors to detect isotope.
10:00-10:30 a.m.	CP	Officers on Duty	Phone/Radio	CP secures 300 square foot area around the radiation source.	Assess effectiveness of CP as initial incident commanders.

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
10:00-10:30 a.m.	UMB EMT	President's Office	Phone/radio	EMD gives Information about suspicious radiation source	Test EMD Communications.
10:00-10:30 a.m.	UMMC EMT	Shock Trauma Center (STC) and Emergency Dept. (ED)	Phone/radio	UMMC EMT informs STC and ED of situation. ED goes on mini-disaster STC goes on fly-by.	Test coordination between the UMMC EMT and hospital units.
10:00-10:30 a.m.	CP	BCFD	In person	BCFD arrives on Campus.	Hand over of Incident Comand CP - BCFD.
10:00-10:30 a.m. Inject 1	CT	BCFD	On Scene Campus Video acess Tablet	Review Historic Data of radiatioin sensor alarm triggering event and determine when suitcase planted.	Determine viability of on-site video tape review.
10:00-10:30 a.m.	EMD/CP	BCFD	Radio	Establish communication between BCFD and Campus Based EM Teams	Test Unified Command Communications
10:45 a.m. Inject 2	Bomber	WJZ	Phone	Bomber alerts the media as to the presence of both bombs: dirty bomb at UMMC and clean bomb at MIEMSS (set to explode around 11:45 a.m.)	Inform BCFD/BCPD that 2 bombs.
10:00-10:30 a.m.	WJZ	IC (911)	Phone/in person	Alert IC of threat by Bomber	Test communication flow and response to information.
10:00-10:30 a.m.	OEA/media reps	UMB-EMT; IC of UMMC; CP (in actuality, probably call 911)	Phone/radio	OEA alerts EMD, AOC and CP of the bomber's threat.	Assess OEA response and ability to disseminate this information quickly.
10:00-10:30 a.m.	OEA on-site media rep	EMT	phone/radio	news media have started arriving at BCFD command post and requesting information	Assess UMB-EMT response to external media needs for information
10:00-10:30 a.m.	BCFD, CP	MIEMSS	Phone	Alert MIEMSS of bomb placement	Assess communication bewtween IC and affected site
10:00-10:30 a.m.	UMB EMT	campus	emergency phone line / UMB web home page	EMT alerts campus about the situation and road closings	Assess EMT response and ability to disseminate this information quickly.
10:00-10:30 a.m.	MIEMSS	MEMA	Phone/Radio	Informs MEMA of situation	Tests notification of State Agencies
10:00-10:30 a.m.	BCFD (Sector 1)	BCFD (Sector 2)	Radio	Request Bomb Squad for 2nd Bomb at MIEMSS	Test access to Bomb Squad and additional responses.
10:50 a.m.	IC (BCFD), joint with UMB EMT	EMD, IC of UMMC and MIEMSS	Phone/radio	IC recommends that the MIEMSS building be evacuated.	Test communications between CP, IC of UMMC, MIEMSS, and the EMD.
10:50 a.m.	BCFD/BCPD	Multiple Agencies	Phone & Radio	Establishment of a wider perimeter which limits traffic access to and egress from UMMC and MIEMSS	Test BCFD ability to control crowd and traffic.

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
10:50 a.m.	IC (BCFD) and MIEMSS Management	MIEMSS staff	Alarm; Phone	Orders evacuation of the MIEMSS building	Test building evacuation plan.
10:50 a.m.	BCFD	BCFD	Radio	Notificationof 2nd section at MIEMSS	Test communication and set up of 2nd IC site at MIEMSS
10:50 a.m.	BCFD	MDE & other State Agencies	Phone	BCFD alerts State Agencies and request assistance	Testability to assess need for help
10:50 a.m.	Experts	IC	Phone/in person	assess need for larger evacuation	Test ability to gauge magnitude of event
10:50 a.m.	IC	IC	In-person	Determines level of event and decides course of action conerning public safety	Assess decision making capabilities of IC and decision implementation
10:50 a.m.	IC	Multiple Agencies	Phone/in person	Enlarge evacuation (if deemed appropraite)	Communication between IC and multple agencies
11:00 a.m.	UMB EMT	Campus Counseling Center (CCC)	Phone	UMB EMT alerts CCC of situation and CCC deploys counselors to an assembly point designated by the UMB EMT.	Assess the response of the CCC. Test identification and establishment of a safe haven.
11:00 a.m.	UMB EMT	Campus; School of Nursing, OCME, fire marshalls (if evacuation is warranted)	Emergency phone line / UMB web home page/phone	UMB-EMT/CP updates campus on 2nd emergency at MIEMSS and possible evacuation of SON or garage	Test communication with fire marshalls and ability of the UMB-EMT to update the campus information rapidly
11:00 a.m.	BCPD	CP	On scene video surveillance tablet review incident to identify bomber	BCFD and BCPD officers review video surveillance tapes covering MIEMSS building and UMMC.	Assess usefulness of historic video data review for situational awareness and bomb detection.
11:00 a.m.	BCPD	IC (BCFD)	In person	BCPD working with BCFD & CP set up an incident command center and initiate crime scene investigation.	Test ability to establish functional unified command communications.
11:05 a.m.	General public; UMB students & staff	Incident Commander		Public descends on UMB campus; several panic-stricken individuals ("worried well") arrive at UMMC and are creating havoc.	Determine ability of IC to control situation and stem panic.
11:05 a.m.	EMD	OEA	Phone	EMD asks OEA to prepare a statement and to determine a location and time for a briefing.	Test collaborative process and ability of OEA to control information flow to media. Are appropriate EHS staff and BCFD experts avaialble to consult if requested?
11:20 a.m.	BCPD	On duty officer FBI	Radio	After review of video tapes and investigation of building, BCFD and BCPD confirm presence of two potential bombs and obtain description of suspect. Alert FBI.	Assess usefulness of historic video data review for situational awareness and bomb detection.

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
11:20 a.m.	BCFD	UMMC/STC	Radio/Phone	Implementation of management plan for potential radiological casualties	Test set up and staffing of decontamination facility. Are appropriate EHS and BCFD experts available to consult if requested?
11:20 a.m.	UMB EMT	OEA on-site media reps	Phone / Radio	UMB EMT gives updated information to media reps on-site with news media	Test EMT's ability to deliver timely information to avoid panic
11:20 a.m.	Media reps	IC	Phone / Radio	OEA instructs IC on location and time of briefing	Information control to reduce panie
11:20 a.m.	Media Reps	Campus and Media	Internet; phone	OEA prepares and posts a statement on the campus website and contacts media.	Test OEA/media relations' ability to present a unified voice for the campus. Evaluate message content.
11:30 a.m.	MEMA	IC	phone	Arrives on Campus to provide assistance with Dirty Bomb.	Threat analysis of Dirty Bomb management.
11:30 a.m.	BCHD; DHMH MEMA	IC	Phone/Radio/Page	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Test implementation of plan for potential radiological casualty management.
11:40 a.m.			Set up Decon Facility	Set-up facility for decontamination of potential radiation victims.	Test decontamination facility set-up
11:40 am Inject #3	CT	All	Suspected Dirty Bomber Apprehend at BWI		
11:40 a.m.	BCPD	IC	Radio/Phone	Informs IC that BCPD has apprehended suspected "Dirty Bomber" and is interrogating him for further information.	
11:45 a.m. Inject #4				Clean bomb (Bomb #1) explodes and destroys SYSCOM	
11:45 a.m.	OEA on-site media rep	EMT	phone/radio	News media ask for updated information to prepare for Noon newscasts	Test ability of UMB EMT to provide timely information for news media
11:50 a.m.	Emergency Medical Technicians (EMTs); BCFD		Radio	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Test emergency response to explosion. Test effectiveness of communication.
12:05 p.m.	IC	OCME	Phone	IC informs OCME of the explosion and reports three fatalities; OCME arrives on the scene shortly after.	Test prolonged extrication abilities and management of the deceased.
12:10 p.m.	IC	UMMC / STC / VAMHS	SYSCOM / FRED / Phone	IC requests bed availability status.	Test Resource Access.

TIME	FROM	TO	MEANS	EVENT DESCRIPTION	OBJECTIVE
	IC	VAMHCS, MEMA / FRED	Phone	EMD gives status report.	Test effectiveness of SYSCOM backup after occurrence of bomb damage.
12:15 p.m.	UMB EMT	campus community	Internet; phone	UMB EMT provides updated information to the campus community on the changing situation	Test ability of the UMB EMT to provide timely updated information to the campus
12:45 p.m.	OEA on-site media rep	UMB-EMT	phone/radio	News media need updated information for 1pm newscasts	Test ability of the UMB EMT to provide timely updated information for news media
12:45 p.m.	IC	FM	Radio / Phone	IC informs FM of damage to MIEMSS building; FM sends staff to MIEMSS to assess damage and restore systems where possible.	Test response capabilities of FM
1:00 p.m.	BCFD			Bomb squad defuses dirty bomb (Bomb #2).	Test ability to handle and defuse radioactive bombs.
1:10 p.m.	IC		Radio	IC implements process for normalization.	Test ability to resume normal operations in an efficient and expedient manner.
1:15 p.m.	OEA on-site media rep	UMB-EMT	phone/radio	News media ask for University official to go news conference/interviews about UMB recovery	Test ability of UMB EMT to provide an official to speak for the University
2:00 p.m.	CT	All	Radio	Demonstration Ends	

2

Notes

2

LAD DEMONSTRATION CONTROLLER TEAM (CT)

Time	Inject	Expected Reaction	Objective
10:30 a.m.	#1 Portable video surveillance access tablet delivered to BCFD (IC) with assistant to operate.	IC will use this video tablet on scene to access cameras overlooking scene and (later) overlooking MIEMSS.	1) Test IC reaction; 2) Identify whether they review historic surveillance camera data when sensor triggered. 3) Assess whether this video data increases situational awareness.
10:45 a.m.	#2 Newsperson calls President's Office to convey information that bomber has planted 2 bombs on campus, one in the MIEMSS Building set to explode at 11:45 am	President's Office will have been informed by EMD of suspicious radiation source and will tell CP that have received a call about 2 bombs. Will put media in contact with OEA.	1) Test how media message gets conveyed to campus; 2) Evaluate how campus media keeps information flowing to city media.
11:05 a.m.	#3 Call for VA cache for Trauma Care	IC will contact VAMC.	1) Assess ability of VAMC to release cache; 2) Test whether VAMC can get cache across to UMMC.
11:30 a.m.	#4 Evacuate OCME because of bomb at MIEMSS.	Evacuate OCME to alternative site? Anatomy Board? Police Barracks?	1) Test decision making about OCME; 2) Determine whether they go to Anatomy Board or Police Barracks..
11:40 a.m.	#5 Suspected "Dirty Bomb" is apprehended at BWI Airport on basis of video surveillance generated description.	BCPD/FBI will start questioning the suspect.	1) Determine whether FBI/BCPD liaison works; 2) Determine how they convey interrogation information to IC.
11:45 a.m.	#6 Bomb explodes at MIEMSS -- destroys SYSCOM and kills 3 BCFD personnel/Alternative: Bomb Squad defuses bomb before explosion	1) Move SYSCOM to back-up system; 2) Call OCME for managing the dead; 3) Consider OCME evacuation.	1) Test the SYSCOM back-up communication; 2) Test OCME fatality management.
1:00 p.m.	#7 Bomb Squad contains "Dirty Bomb" and defuses it.	1) Signals threat reduction and start of restoration of operations.	Test how plans to implement normalization are implemented.

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
9:45 a.m.	CT	Start Exercise; bomber plants a clean bomb (Bomb #1) on roof of MIEMSS Bldg; dirty bomb (Bomb #2) placed at loading dock at UMMC.	Was bomber observed?				
10:00 a.m.	CT	Radiation sensor near loading dock at UMMC triggers.	Test radiation sensor detection of "dirty bomb" made from stolen cesium and transmissions of telephone alert system to CP/EHS/CT. Did sensors alert to detection of Rad?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	AOC	UMMC sets up incident command using HEICS	Was UMMC incident command established? Was Heics implemented?				
10:00-10:30 a.m.	BCFD	Alert MIEMSS of bomb placement	Did IC comtact MIEMSS about bomb?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	BCFD (Sector 1)	Request Bomb Squad for 2nd Bomb at MIEMSS	Was bomb squad contacted?				
10:00-10:30 a.m.	CP	CP requests assistance from the BCFD and BCPD with suspicious radiation source.	Did CP contact a) BCFD; b) BCPD; c) EHS about radiation?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP	CP inform EMD of the presence of the potential problem at UMMC, and review video surveillance images of the area around the radiation sensor.	a) Did CP communicate with EMD? B) Did CP use video surveillance camera? C) Did RS respond promptly? D) Did RS have appropriate instrumentation?				
10:00-10:30 a.m.	CP	CP secures 300 square foot area around the radiation source.	Were CP effective as initial incident commanders?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP	BCFD arrives on Campus.	Did hand over of Incident Comand CP - BCFD go smoothly?				Assess effectiveness of establilshment police control? Worst 1 2 3 4 5 Best
10:00-10:30 a.m.	CP	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	a) Did EHS and investigation of radiation sensor alarm go expeditiously? b) Did the auto dial work? c) Did EHS and CP notify each other of sensor alarm?				
10:00-10:30 a.m.	CP	Establish communication between BCFD and Campus Based EM Teams	Unified Command Communications				Unified Command Communications Worst 2 3 4 5 Best

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	CP and/or EMD	Inform UMMC of potential problem	Communication between UMB and UMMC				Communication between UMB and UMMC Worst 1 2 3 4 5 Best
10:00-10:30 a.m.	CT	CP asks EHS to investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with EHS and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm?				
10:00-10:30 a.m.	EHS	EHS tells CP they will investigate radiation sensor alarm. EHS sends a Radiation Safety Officer to the area.	Test communication with CP and investigation of radiation sensor alarm. Did the auto dial work? Did EHS and CP notify each other of sensor alarm? What method of communication was used?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	EHS	EHS informs CP that the radiation is coming from a suspicious source.	Test internal notification of problem and detection of radiation threat. Test adequacy of training and equipment to find source of radiation and differentiate it from medical isotopes. Did RS locate suspicious source and inform CP? Who notifies who?				
10:00-10:30 a.m.	EHS	Determines that a significant source of radiation at UMMC is coming from a briefcase left on the loading dock. EHS alerts CP. EHS suggests secure 300 feet perimeter.	Assess EHS ability to determine that the radiation source is suspicious. Test whether RS has correct sensors to detect isotope.				
10:00-10:30 a.m.	EMD	EMD alerts UMB EMT of potential crisis. He may convene at the Pearl Street Garage Operations Center (PSGOC).	How was UMB EMT responsiveness, when activated. Who curtails current operation to establish contingency operations?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	EMD	Establish communication between BCFD and Campus Based EM Teams	Were Unified Command Communications effective? What is primary communication mode? What is the backup plan?				
10:00-10:30 a.m.	EMD and/or CP	Inform UMMC of potential problem. Is the potential problem identified? Who at UMMC is notified?	Was this communication between UMB and UMMC?				
10:00-10:30 a.m.	EMD and/or CP	Inform UMMC of potential problem	Test communication between UMB and UMMC.				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	Hospital Security	Inform UMMC of potential problem	Who notifies who? What is the trigger for notification?				
10:00-10:30 a.m.	MIEMSS	Informs MEMA of situation	Tests notification of State Agencies --POC list --- Order notified --- Lost time list updated --- Is it complete?				
10:00-10:30 a.m.	OEA on-site media rep	news media have started arriving at BCFD command post and requesting information	Assess UMB-EMT response to external media needs for information --- Prepare statement --- Secure area for media				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	OEA/media reps	OEA alerts EMD, AOC and CP of the bomber's threat.	Assess OEA response and ability to disseminate this information quickly. --- Media notification plan				
10:00-10:30 a.m.	UMB EMT	EMD gives Information about suspicious radiation source	Test EMD Communications. --- Primary/alternate communications --- Notification roster --- Who initiates				
10:00-10:30 a.m.	UMB EMT	EMT alerts campus about the situation and road closings	Assess EMT response and ability to disseminate this information quickly.--- Mode of communications and backup --- Notification roster --- Is OEA on it? --- Alternate routes given for emergency vehicles				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:00-10:30 a.m.	UMMC EMT	UMMC EMT informs STC and ED of situation. ED goes on mini-disaster STC goes on fly-by.	Test coordination between the UMMC EMT and hospital units. --- Was EMP followed? --- Notification roster --- Primary/back-up communications				
10:00-10:30 a.m.	WJZ	Alert IC of threat by Bomber	Test communication flow and response to information. --- Notification chain --- Verification of incident --- Coordinate joint press release				
10:00-10:30 a.m. Inject 1	CT	Review Historic Data of radiation sensor alarm triggering event and determine when suitcase planted.	Was viability of on-site video tape review possible? Did review of surveillance video occur?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:45 a.m. Inject 2	Bomber	Bomber alerts the media as to the presence of both bombs: dirty bomb at UMMC and clean bomb at MIEMSS (set to explode around 11:45 a.m.)	Inform BCFD/BCPD that 2 bombs.				
10:50 a.m.	BCFD	Notification of 2nd sector at MIEMSS	Did BCFD set up 2nd sector at MIEMSS?				
10:50 a.m.	BCFD	BCFD alerts State Agencies and request assistance	Was help requested from State agencies?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	BCFD	Establishment of a wider perimeter which limits traffic access to and egress from UMMC and MIEMSS	a) Was perimeter established? B) Was traffic controlled? C) Was crowd controlled?				
10:50 a.m.	BCPD	Establishment of a wider perimeter which limits traffic access to and egress from UMMC and MIEMSS	Was BCPD able to control crowd and traffic?				
10:50 a.m.	Experts - BCPD, BCFD, FBI	Assess need for larger evacuation	Was magnitude of event gauged correctly? Are there default plans from BCFD on such an event? Can RS determine type of isotope to rule out neclear detonation? Can BCFD/BCPD determine "worst-case" scenario for dirty bomb based on size of suitcase? Can BCFD/BCPD contain the blast to reduce contamination?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	IC	Determines level of event and decides course of action conerning public safety	Were decision making capabilities of IC and decision implementation adequate?-- EMP available?				
10:50 a.m.	IC	Enlarge evacuation (if deemed appropraite)	Communication between IC and multple agencies -- Copy of POC list --- Order they are called				Communication between CP and IC 1 2 3 4 5
10:50 a.m.	IC (BCFD)	Orders evacuation of the MIEMSS building	Evac plan -- who initiates; Were floor fire wardens notified; Rally points identified; Personnel accountability				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
10:50 a.m.	IC (BCFD), joint with UMB EMT	IC recommends that the MIEMSS building be evacuated.	Communications between CP, IC of UMMC, MIEMSS, and the EMD. Copy of POC list available and instructions				
10:50 a.m.	MIEMSS Management	Orders evacuation of the MIEMSS building	Test building evacuation plan. -- Who initiates? --- Floor fire wardens notified --- Rally points identified --- Personnel accountability				
10:50 a.m.	UMB joint with EMT IC (BCFD)	IC recommends that the MIEMSS building be evacuated.	Test communications between CP, IC of UMMC, MIEMSS, and the EMD. ---Copy of POC list and instructions -- Primary and secondary modes of communication				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:00 a.m.	BCPD	BCFD and BCPD officers review video surveillance tapes covering MIEMSS building and UMMC.	Was historic video data review used for situational awareness and bomb detection?				
11:00 a.m.	BCPD	BCPD working with BCFD & CP set up an incident command center and initiate crime scene investigation.	Was a functional unified command communications established?				
11:00 a.m.	UMB EMT	UMB EMT alerts CCC of situation and CCC deploys counselors to an assembly point designated by the UMB EMT.	Assess the response of the CCC. Test identification and establishment of a safe haven.-- How notified -- Information given including route to scene				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:00 a.m.	UMB EMT	UMB-EMT/CP updates campus on 2nd emergency at MIEMSS and possible evacuation of SON or garage	Test communication with fire marshalls and ability of the UMB-EMT to update the campus information rapidly --- Notification Roster --- Primary/Alternate comunications				
11:05 a.m.	EMD	EMD asks OEA to prepare a statement and to determine a location and time for a briefing.	Did OEA control information flow to media. Are appropriate EHS staff and BCFD experts avaialble to consult if requested? Should the unified command be the ONLY source for information?				
11:05 a.m.	General public; UMB students & staff	Public descends on UMB campus; several panic-stricken individuals ("worried well") arrive at UMMC and are creating havoc.	Was IC able to control situation and stem pani?. Has the IC managed expectations by releasing information that minimizes the effect that rumors will generate? Have the media been responsible in the reporting of the event as it unfolds? Is there a plan to care for panic-stricken patients by isolating them from the public at large?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:20 a.m.	BCFD	Implementation of management plan for potential radiological casualties	Was an alternative site for Decon establishe?Were appropriate EHS and BCFD experts available to consult?				
11:20 a.m.	BCPD	After review of video tapes and investigation of building, BCFD and BCPD confirm presence of two potential bombs and obtain description of suspect. Alert FBI.	Was historic video data review used for situational awareness and bomb detection?				
11:20 a.m.	Media reps	OEA instructs IC on location and time of briefing	Information control to reduce panie -- Prepared statement --- Secure area for press --- Time of updates				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:20 a.m.	Media Reps	OEA prepares and posts a statement on the campus website and contacts media.	Test OEA/media relations' ability to present a unified voice for the campus. Evaluate message content. --- Timeliness of message				
11:20 a.m.	UMB EMT	UMB EMT gives updated information to media reps on-site with news media	Test EMT's ability to deliver timely information to avoid panic -- Coordinate w/OEA --- Verify info				
11:30 a.m.	BCHD	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Was a plan developed for potential radiological casualty management?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:30 a.m.	DHMH	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Did plan for potential radiological casualty management get determined? Was plan available? Which plan used -- Local___ State___ Who decided to implement radiological plan? Local ___ State____				
11:30 a.m.	MEMA	Local and state officials arrive to provide assistance in managing "dirty bomb" consequences.	Test implementation of plan for potential radiological casualty management.				
11:30 a.m.	MEMA	Arrives on Campus to provide assistance with Dirty Bomb.	Threat analysis of Dirty Bomb management. -- Hotzone established --- Initial test --- NRC involved --- Federal Agencies notified -- Evacuation of building in the immediate area				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:40 a.m.	BCPD	Informs IC that BCPD has apprehended suspected "Dirty Bomber" and is interrogating him for further information.	Was this information communicated to other agencies?				
11:40 a.m.		Set-up facility for decontamination of potential radiation victims.	Test decontamination facility set-up				
11:40 am Inject #3	CT	--	--				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:45 a.m.	OEA on-site media rep	News media ask for updated information to prepare for Noon newscasts	Test ability of UMB EMT to provide timely information for news media --- Established times for update				
11:45 a.m. Inject #4		Clean bomb (Bomb #1) explodes and destroys SYSCOM					
11:50 a.m.	BCFD	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Was explosion response coordinated?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
11:50 a.m.	Emergency Medical Technicians (EMTs)	BCFD extinguishes fire and extricate wounded BCFD personnel; EMTs tend to wounded.	Was emergency response to explosion effective? Test effectiveness of communication.				
12:05 p.m.	IC	IC informs OCME of the explosion and reports three fatalities; OCME arrives on the scene shortly after.	Were prolonged extrication abilities and management of the deceased adequate. -- Press release --- Evac plan --- Mortuary affairs				
12:10 p.m.	IC	IC requests bed availability status.	Test Resource Access. --- Phone # to PAD --- Bed status by type				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
12:10 p.m.	IC	EMD gives status report.	Test effectiveness of SYSCOM backup after occurrence of bomb damage. --- Users trained				
12:15 p.m.	UMB EMT	UMB EMT provides updated information to the campus community on the changing situation	Test ability of the UMB EMT to provide timely updated information to the campus -- Established times for updates				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
12:45 p.m.	IC	IC informs FM of damage to MIEMSS building; FM sends staff to MIEMSS to assess damage and restore systems where possible.	Test response capabilities of FM --- How notified --- Information given, including route to scene				
12:45 p.m.	OEA on-site media rep	News media need updated information for 1pm newscasts	Test ability of the UMB EMT to provide timely updated information for news media--- Principle POC in IC for info --- Times IC POC				
1:00 p.m.	BCFD	Bomb squad defuses dirty bomb (Bomb #2).	Test ability to handle and defuse radioactive bombs. Were necessary precautions taken to defuse?				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
1:10 p.m.	IC	IC implements process for normalization.	Were normal operations resumed in an efficient and expedient manner? --- Disengagement plan				

Plan Time	From	Event Description	Evaluation	✓	Time Done	Agencies	Comments/Activities/Who talked to whom? What information exchanged?
1:15 p.m.	OEA on-site media rep	News media ask for University official to go news conference/interviews about UMB recovery	Test ability of UMB EMT to provide an official to speak for the University--- University spsokesman identified early on --- Who in OEA is giving them info --- Single POC for info flow to spokesman				
2:00 p.m.	CT	Demonstration Ends	--				

Individual UMB Division/Department Objectives Tested

(Examples are illustrative and not all inclusive)

All: Test ability to have division/department keep EMT informed (through their staff representative on the EMT) and to get information from the EMT (through their staff representative

CCC: Test Campus Counseling Center's ability to set up Crises Information Centers and provide information to concerned staff, students, visitors and others.

CP: Test their response to suspicious package, radiation etc.
Test their ability to contain/isolate an area of campus.
Test their Incident Command ability as they take charge of the area and later serve as part of a unified command at the scene.

EHS: Test their response to unknown radiation source.
Test their ability to advise EMT on specific radiation risk assessment.
Test their ability to advise and assist other emergency responders as needed.

FM: Test ability to isolate building(s) for Shelter-In-Place.

OCME: Test Internal Plan for managing the dead.

LIST OF ACRONYMS

AOC	Administrator on Call for hospital
BCFD	Baltimore City Fire Department
BCHD	Baltimore City Health Department
BCPD	Baltimore City Police Department
CCC	Campus Counseling Center
CP	Campus Police
CT	Controller Team
DHMH	Maryland Department of Health and Mental Hygiene
ED	Emergency Department for UMMC
EHS	Environmental Health and Safety
EMD	UMB Campus Emergency Management Director
EMTs	Emergency Medical Technicians
FM	Facilities Management
FRED	Facilities Resource Emergency Database
HEICS	Hospital Emergency Incident Command System
IC	Incident Commander
MEMA	Maryland Emergency Management Agency
MIEMSS	Maryland Institute of Emergency Medical Services Systems
MPC	Maryland Poison Center
OCME	Office of the Chief Medical Examiner
OEA	Office of External Affairs (Media Relations)
PSGOC	Pearl Street Garage Operations Center
RS	Radiation Safety
STC	Shock Trauma Center
UMB	University of Maryland, Baltimore
UMMC	University of Maryland Medical Center
UMMS	University of Maryland Medical System
UMB EMT	Campus (UMB) Emergency Management Team
UMMC EMT	Emergency Management Team for UMMC
USAF	United States Air Force
VAMHCS	Veterans Administration Maryland Health Care System

3

Notes

3

FOR AFTER ACT[illegible]N HOTWASH REVIEW

EXERCISE DEBRIEFING LOG

Exercise LAD Demo March 26, 2004 Recorder Date

Problem Summary	Recommended Action	Resp. Agency/Person

EXERCISE DEBRIEFING LOG

Exercise LAD Demo March 26, 2004 Recorder Date

Problem Summary	Recommended Action	Resp. Agency/Person

EXERCISE DEBRIEFING LOG

Exercise LAD Demo March 26, 2004 Recorder Date

Problem Summary	Recommended Action	Resp. Agency/Person

EXERCISE DEBRIEFING LOG

Exercise LAD Demo March 26, 2004 Recorder Date

Problem Summary	Recommended Action	Resp. Agency/Person

EXERCISE DEBRIEFING LOG

Exercise LAD Demo March 26, 2004 **Recorder** **Date**

Problem Summary	Recommended Action	Resp. Agency/Person

4

Notes

4

LAD -- Master Communication List

Evaluators

Buttons and vests for identification
Training times
Thursday PM 3/25
Friday 3/26 8:00 a.m. – 10:00 a.m.

MIEMSS
Rene Fechter (410) 608-8933
Margaret McEntee 6-3843 / Beeper (410) 291-6640

Loading Dock
Carl Johnson (410) 707-4071 (also controller)
Jim Jaeger (410) 961-6072 (also controller)

UMB Command Center (Pearl Street Garage)
Chris Gozdor (410) 706-2156
Edward Kensinger (706) 399-6223

UMMC Command Center
Diane Wynne VA Rep

EHS
Steve Hand
VA Rep.

Incident Command Center
Dave Moore – Cell (410) 322-6039
Clark DuCharme (706) 399-6224

Floater
Jerry Stockton
Thomas Benner

Drill Control Center
Jon Mark Hirshon
Karyn Bergmann
Linda Pelletier – (410) 328-3467 / Beeper (410) 389-9408
Wayne Peters
Roger Shere-Wolfe
Claudia Oglivie

LAD -- Master Communication List

Control Team Cell Phones

MIEMSS
John Donahue - Cell (410) 207-0071 / Pager (410) 475-3683
Rene Fechter - Cell (410-608-8933) / Pager (410) 678-8339

Loading Dock
Jim Jaeger (410-961-6072)
Greg Sackett (410-963-4533)
Carl Johnson – (410) 707-4071 / Pager (410) 328-2337 – ID# 1878

UMB Command Center (Pearl Street Garage)
Pat Tate (410) 615-5133
Connie Knoll (617) 645-5295 / Pager (410) 389-0448

UMMC Command Center
Jim Radcliff (443) 794-0866 / Pager (410) 328-2337-ID# 2413

EHS
Patrick Wolf – Cell (410) 963-4529

Incident Command Center
Ken Hyde – Cell (443) 690-4778

Drill Command Center (410) 328-8426 or (410) 328-7781
Colin Mackenzie (410-627-5616) / Pager (410) 328-2337 ID# 1422 (use pager or call 8-9267 direct)
Jon Mark Hirshon (410-271-4825) / Pager (410) 351-6766

Designated Control Center (410) 328-7781
National Study Center for Trauma and EMS

Stop Exercise Term: STOP-X (Said three times)

LAD -- Master Communication List

Agency participation from

City:

BCFD

Key Contact Person: Ken Hyde – cell (443) 690-4778 /John Links

BCPD

Key Contact Person: Chuck Schneider

BCHD

Key Contact Person: Ruth Vogel

State:

DHMH

Key Contact Person: Al Romanosky

Governor's Office

Key Contact Person: Dennis Schrader

MIEMSS

Key Contact Person: John Donahue – (410) 207-0071

MEMA

Key Contact Person: Carl Phelps/Christina Mays

MDE

Key Contact Person: Mike Scherin (?sp)

University

UMMS

Key Contact Person: Linda Pelletier – Ofc. (410)328-3467 / Cell (410) 258-9712
Beeper (410) 389-3408

UMB

Key Contact Person: Bob Rowan – 6-7222

Environmental Health

Key Contact Person: Jim Jaeger – 6-7055 / Beeper (410) 961-6072

Campus Police

Key Contact Person: Ron Sappington – **DO NOT CALL 911 – Use:** 6-6683 / 6-6802 / 6-6882

VA

Key Contact Person: John Magness
Robin Rossiter – (717) 818-4249

Media

Channel 13

Key Contact Person: Christine Coleman Taylor – (410) 365-8744

STC Media

Cindy Rivers – 8-8778

MIEMSS Media

Jim Brown – 6-3994

LAD -- Master Communication List

Other Contacts:

Notify FBI of drill- Eric Moorefield
Notify State Police- Lt. Mark Gabriel
Notify 911 operators of drill
Notify internal operators of drill
PIO – BCFD – Kevin Cartwright
PIO – BCPD – Matt Jablow

Communications Support
Peter Hu
Tim Brooks
Steve Seebode
Tamas Gal

Video Support
Link Communications, LTD.
Jacob Seagull - Cell (410) 499-5839 / Beeper (410) 328-2337 ID# 7680
Hao Hu
David Gagliano
And others

5

Notes

5

SUMMARY EVALUATION
LOCAL AREA DEFENSE DEMO
March 26th

EVALUATOR'S NAME:

LOCATION:

UNIT/DEPARTMENT/ACTIVITY OBSERVED:

TIME START: ________________ TIME STOPPED:_______________

THE FOLLOWING QUESTIONS SHOULD BE USED AS A GUIDE IN OBSERVING THE EXERCISE. ALL QUESTIONS SHOULD BE ANSWERED WITH MORE THAN JUST YES OR NO. IF A QUESTION DOES NOT APPLY TO THAT PARTICULAR RESPONSE FUNCTION BEING OBSERVED, N/A SHOULD BE PLACED INTHAT BLOCK. IF MORE SPACE IS NEEDED, PLEASE WRITE ON THE BACK OR ON ANOTHER PIECE OF PAPER NUMBERING THE CONTINUATION WITH THE SAME NUMBER AS THE QUESTION. THIS FORM IS TO BE RETURNED TO THE EXERCISE COORDINATOR AT THE CONCLUSION OF THE EXERCISE.

1. HOW DID THE ACTIVITY BEGIN?

2. WHO WAS IN CHARGE?

	WORST				BEST
3. WAS THERE A SMOOTH TRANSFER OF AUTHORITY AND/OR STAFF?	1	2	3	4	5

4. WERE THE DISASTER PLAN/PROCEDURES FOLLOWED? Y / N

Y / N

5. WAS THE SITUATION ASSESSED AND EVALUATED PROPERLY BY THE PARTICIPANTS? Y / N

Y / N

6. DID THE PARTICIPANTS APPEAR TO KNOW WHAT THEY WERE DOING? Y / N

7. WAS THERE A SENSE OF CONFUSION? Y / N

8. WAS THERE ADEQUATE STAFFING? Y / N

9. WERE BOTH ON SHIFT AND OFF SHIFT PERSONNEL NOTIFIED AND TOLD TO EITHER REPORT TO THE HOSPITAL OR STAY ON ALERT? **Y / N**

10. WAS SECURITY ENFORCED AND EFFECTIVE? **Y / N**

11. WAS EQUIPMENT USED CORRECTLY? **Y / N**

12. DID THE EQUIPMENT FUNCTION PROPERLY? **Y / N**

WORST **BEST**

13. RATE COMMUNICATIONS BETWEEN STAFF MEMBERS. **1 2 3 4 5**
(CIRCLE COMMENT): OUTSTANDING ADEQUATE MARGINAL UNSATISFACTORY

14. WAS THERE ADEQUATE COMMUNICATION WITH OTHER DEPARTMENTS? **Y / N**

15. WAS THERE COORDINATION WITH OTHER DEPARTMENTS? **Y / N**

16. WAS THE COORDINATION BETWEEN DEPARTMENTS EFFECTIVE? **Y / N**

17. WERE STAFF MEMBERS KEPT INFORMED ABOUT THEIR SPECIFIC OPERATION AND WHAT THE GENERAL SITUATION WAS? **Y / N**

18. DID PERSONNEL RESPOND IN A TIMELY MANNER? **Y / N**

19. WERE FACILITIES ADEQUATELY EQUIPPED? **Y / N**

20. DID THE SCENARIO ADEQUATELY TEST PERSONNEL AND EQUIPMENT? **Y / N**

21. BENEFIT OF THE EXERCISE TO THE PARTICIPANTS:

22. WHAT WAS THE OVERALL CAPABILITY OF THE UNIT/DEPARTMENT TO RESPOND TO AN EMERGENCY?

23. SUMMARY AND RECOMMENDATIONS:

DEPARTMENT CHECKLIST

SECURITY DEPARTMENT

	WORST				BEST
1. PERSONNEL RESPONDED IN A TIMELY FASHION?	1	2	3	4	5
2. DID THEY ACTIVATE COMMUNICATION SYSTEMS?	1	2	3	4	5
3. DID THEY NOTIFY ADDITIONAL PERSONNEL?	1	2	3	4	5
4. WERE WHERE PERSONNEL SENT TO LOCATIONS AS SPECIFIED IN PROCEDURES?	1	2	3	4	5
5. DID THEY INTERFACE WITH LOCAL POLICE?	1	2	3	4	5
6. DID EQUIPMENT WORK PROPERLY?	1	2	3	4	5
7. DID PERSONNEL CONTROL PATIENT/VISITOR/EMPLOYEE ACCESS TO THE VARIOUS AREAS?	1	2	3	4	5
8. DID THEY FOLLOW THEIR PROCEDURES?	1	2	3	4	5
9. DID THEY COORDINATE WITH OTHER DEPARTMENTS?	1	2	3	4	5

COMMUNICATIONS DEPARTMENT

1. DID PERSONNEL RESPOND IN A TIMELY FASHION?	1	2	3	4	5
2. DID EQUIPMENT FUNCTION PROPERLY?	1	2	3	4	5
3. WERE WHERE COMMUNICATION DEPARTMENT PERSONNEL NOTIFIED?	1	2	3	4	5
4. DID THEY CONTROL RUMORS EFFECTIVELY?	1	2	3	4	5
5. WHERE THEY PROVIDED WITH, OR DID THEY ASK FOR INFORMATION TO ANSWER QUESTIONS FROM THE PUBLIC?	1	2	3	4	5
6. DID THEY KEEP A LOG OF COMMUNICATIONS?	1	2	3	4	5

	WORST				BEST
7. DID THEY IMPLEMENT PROCEDURES IN NOTIFYING PERSONNEL IN OTHER DEPARTMENTS	1	2	3	4	5

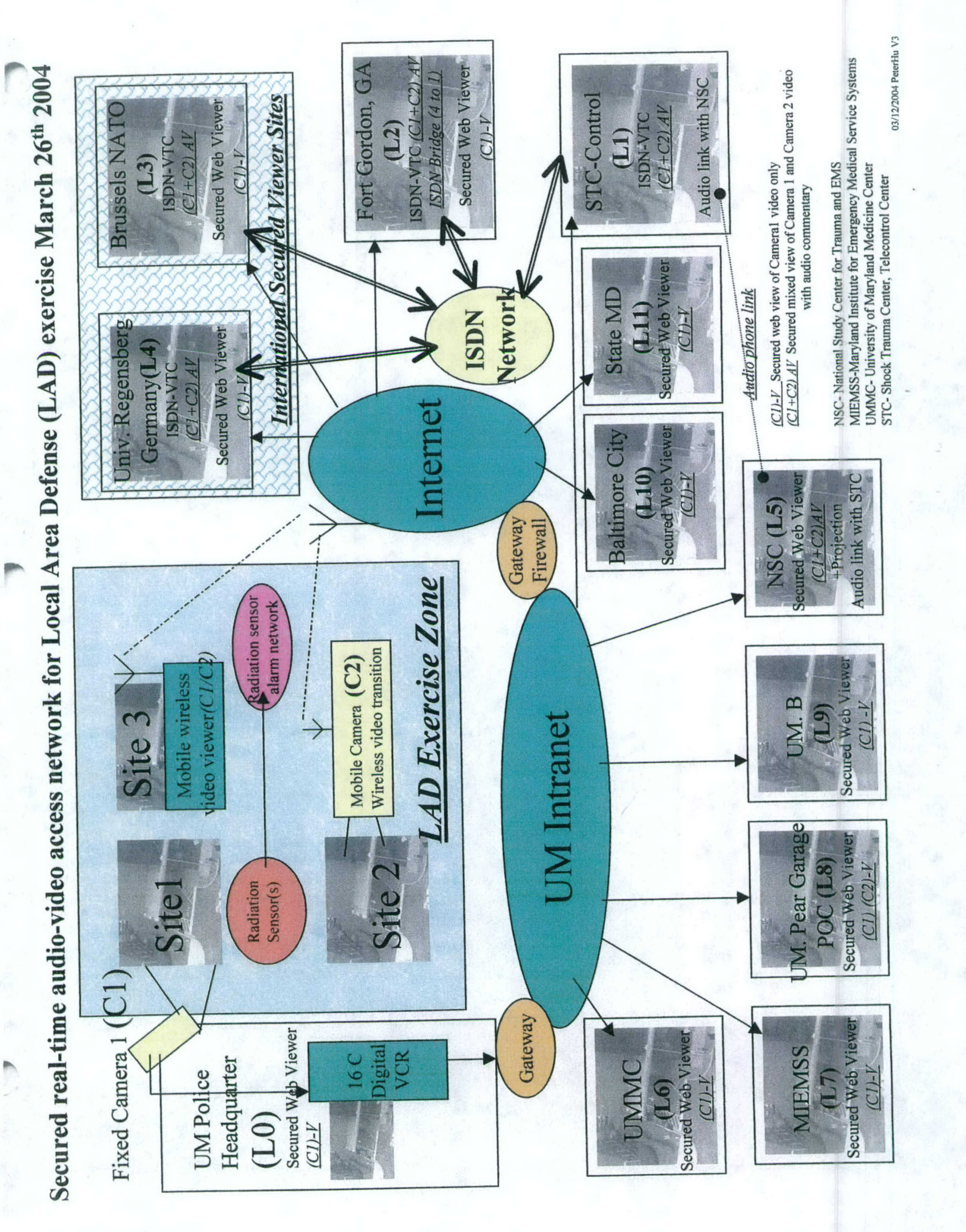
COMMAND AND CONTROL

1. DID PERSONNEL RESPOND IN A TIMELY MANNER?	1	2	3	4	5
2. DID THE INDIVIDUAL NAMED IN THE DISASTER PLAN TAKE CONTROL?	1	2	3	4	5
3. IF APPROPRIATE, WAS THERE A SMOOTH TRANSITION OF AUTHORITY?	1	2	3	4	5
4. WAS ADEQUATE INFORMATION OBTAINED FROM THE VARIOUS DEPARTMENTS TO MAKE EFFECTIVE DECISIONS?	1	2	3	4	5
5. WAS THE COMMAND CENTER MADE OPERATIONAL?	1	2	3	4	5
6. WERE THE EQUIPMENT AND DISPLAYS IN THE COMMAND CENTER EFFECTIVE?	1	2	3	4	5
7. WERE THERE ENOUGH STAFF MEMBERS IN THE COMMAND CENTER AND WERE THEY RIGHT TYPES?	1	2	3	4	5
8. WERE THE PROCEDURES FOLLOWED?	1	2	3	4	5

PRESS ROOM

1. DID PERSONNEL RESPOND IN A TIMELY FASHION?	1	2	3	4	5
2. WAS THE PRESS ROOM MADE OPERATIONAL WITHIN THE PRESCRIBED TIME LIMITS?	1	2	3	4	5
3. DID ALL THE EQUIPMENT WORK PROPERLY?	1	2	3	4	5
4. WAS SECURITY ESTABLISHED AND BADGES ISSUED TO MEMBERS OF THE PRESS?	1	2	3	4	5
5. WERE PRESS RELEASES AND PRESS BRIEFINGS GIVEN WITH ENOUGH FREQUENCY?	1	2	3	4	5
6. WERE HOSPITAL SPOKESPERSONS INFORMATIVE AND CREDIABLE?	1	2	3	4	5
7. WERE PROCEDURES FOLLOWED?	1	2	3	4	5

ATTACHMENT #9 – Connections made for Remote Emergency Operation Center



ATTACHMENT #10 - Remote Evaluation (NATO & Univ. Regensberg, Germany)

POST EVALUATION OF REMOTE OBSERVATION LAD DEMONSTRATION EXERCISE, MARCH 26, 2004

Please return completed form to National Study Center for Trauma and EMS, 701 W. Pratt Street, 5th Fl. (FOLD – Address on back – staple and mail). Alternatively please fax to (USA) 410-328-2841 or email to cmack003@umaryland.edu. *Thanks for your help!*

I am (check): ☐ Medical ☐ Police ☐ Fire Department ☐ Military ☐ Civil Defense ☐ Other: ______________________

Please circle the appropriate number 1-5 for your response to the questions below.

1 Strongly Disagree	2 Disagree	3 Don't Agree or Disagree	4 Agree	5 Strongly Agree

	1	2	3	4	5
1. The Demonstration seen by Telemedicine was realistic.	1	2	3	4	5
2. The Exercise helped me prepare for a similar real event.	1	2	3	4	5
3. The Campus/City emergency coordination was increased by the Exercise.	1	2	3	4	5
4. For me, the Exercise revealed the following about the Emergency Management Plan (EMP)					
a) Increase my knowledge of the University of Maryland (UM) Campus EMP	1	2	3	4	5
b) Ease of Inter-Campus Communications	1	2	3	4	5
c) Importance of coordination of Campus EMP with outside agencies.	1	2	3	4	5
d) Need for early involvement of City in Campus EMP.	1	2	3	4	5
e) Confidence in my decision about how to manage a similar scenario.	1	2	3	4	5
f) Identified how I can help the UM Campus EMP	1	2	3	4	5
g) Improved my understanding of how events change rapidly.	1	2	3	4	5
h) Showed me the need for media communication strategy.	1	2	3	4	5
i) Revealed a requirement for a single spokesperson.	1	2	3	4	5
j) Importance of control of the "Walking Worried".	1	2	3	4	5
k) Showed an integrated response between Campus/City/State Emergency Responders	1	2	3	4	5
l) Maximum use of Campus Resources	1	2	3	4	5

List 3 strengths of using Telemedicine for the Demonstration Exercise:

1. ______________________

2. ______________________

3. ______________________

List 3 weaknesses of using Telemedicine for the Demonstration Exercise:

1. ______________________

2. ______________________

3. ______________________

What opportunities did you see for an improved use of Telemedicine in emergency response?

____

____

____

What threats did you see to using Telemedicine to coordinate emergency response?

____

____

____

Site of Demo Involvement - ______________________

Evaluation Question Kit

1. Prior to the start of the drill: read this document
2. During the drill: make notes about the decisions that you have made
3. At quiet moment during the drill after at least 45 minutes answer questions in section A and B, and circle your answers in section C. Please complete section D at the end of the drill.
4. After the drill: email your completed data forms to Colin Mackenzie, cmack003@umaryland.edu or fax your hand written form to (USA) 410-328-2841.

Background This kit is part of the effort to evaluate telemedicine technology developed to improve the decision making and coordination in emergency medical systems such as the Local Area Defense (LAD) Demonstration. The key feature of telemedicine systems is to enable decision makers remote from the patient(s) to view video images captured at the patient site. *Video assisted coordination* may change the way in which EMS personnel communicate in certain situations.

Objective To examine the utility of telemedicine, in the UM Campus/Baltimore City and Maryland State LAD Demonstration. This is a jointly staged exercise of managing a terrorist incident on the UM Campus. As a remote decision maker participating in this exercise, your opinions about your experience are extremely important and valuable to us.

Audio recording To better capture your responses to questions, we will audio video record this session. Written documents resulting from your answers will have no direct links to you; any direct references to you in publications of any kind will only occur with your explicit permission.

Questions. Questions are in three areas:

- Your opinions on the use of telemedicine related to the LAD Demo
- Your opinions on the use of video in decision making and coordination of EMS in general
- Your opinions on the use of the images in terrorist threats such as the LAD Demo.

A. This LAD Demonstration

- Additional decisions: Did the remote visual information enable you to make decisions that could not have made based on verbal descriptions alone? If yes, what decisions were you able to make? Based on what specific visual images?
- Added information: In what aspects (if any) did access to remote visual information provide you with better information about the issues under your consideration?
- Confidence of decision making: How did the addition of visual information improve your decision making and/or increase the confidence in your decisions?
- Adequacy of visual information: In comparison to personnel physically present at the scene, what information was **un**available to you? How would the **un**available information have influenced your decision making?
- Selected decision making areas: Please elaborate on any of the decisions below that you have considered during the exercise. Provide your assessment of confidence in decision making and speed of arriving at a decision.
- User Interfaces: What aspects of the user interface did you like or find useful? What aspects of the user interface did you not like or difficult to use?
- Potential design improvement: How would you improve the user interface or change the overall system design?

B. General

- Did you identify a value to using telemedicine to receive visual data from the scene? If yes, what value did you identify? Who are most likely to benefit from this information?

- How would you change existing emergency management protocols to accommodate telemedicine practices?
- How do you see telemedicine changing the way we currently provide emergency/disaster care and logistical support?

C. Numerical responses

Please circle the number that corresponds to your agreement to the following statements.

1	2	3	4	5
Strongly Disagree	*Disagree*	*Don't Agree or Disagree*	*Agree*	*Strongly Agree*

1. I was able to make decisions based on remote visual information that were not possible using verbal information alone	1	2	3	4	5
2. I was better informed because of remote visual information.	1	2	3	4	5
3. The remote visual information changed my decision making	1	2	3	4	5
4. The remote visual information increased the confidence I have in my decisions	1	2	3	4	5
5. In comparison with that of those physically present at the scene, I was able to gather the same information that they did.	1	2	3	4	5
6. The remote visual information provides me with useful additional information.	1	2	3	4	5
7. I was as informed as those physically present at the scene.	1	2	3	4	5
8. As a (Circle One Below) □ trauma surgeon □ Fire Department □ emergency physician □ Law Enforcement □ nurse □ Military □ EMS □ Other ____________ access to remote visual information greatly improved my ability in					
(a) Preparation	1	2	3	4	5
(b) Guiding field emergency procedures	1	2	3	4	5
(c) Coordination	1	2	3	4	5
9. The views provided met my needs.	1	2	3	4	5
10. The transmission of the video images poses intrusion to terrorist victims privacy.	1	2	3	4	5
11. The transmission of the video images of EMS activities poses an intrusion in my privacy.	1	2	3	4	5
12. I am uncomfortable having my performance available to an off-site observer.	1	2	3	4	5
13. Operation of a telemedicine system distracts the crew's attention to such a degree that the safety is compromised.	1	2	3	4	5
14. Operation of a telemedicine system delays regular essential steps in emergency/disaster management.	1	2	3	4	5
15. The terrorist victim would feel comfortable with the presence of a telemedicine system.	1	2	3	4	5
16. Acquiring and transmitting video images lengthens the emergency management time.	1	2	3	4	5
17. Using a telemedicine system poses an additional workload on the emergency care providers.	1	2	3	4	5

18. Transmission of the video images provide remote decision makers information that is otherwise impossible for me to convey yet critical for their decision making.	1	2	3	4	5
19. Availability of video images to off-site observers would enable me to communicate better and easier.	1	2	3	4	5

D. Comments

Please write your comments regarding the telemedicine system as used in the LAD Demonstration.

COMPARISON OF STILL IMAGES WITH LIVE SLOW VIDEO TRANSMISSIONS

I. The Live slow Video (like that shown in the LAD Demo) would be useful for:

Please circle the appropriate number 1-5 for your response to the questions below.

[redacted]

1. Disasters where a knowledgeable person provided audio commentary.	1 2 3 4 5
2. Incident Commander for Emergency Response coordination in Terrorist threat agent release in local area.	1 2 3 4 5
3. Trauma patient extrication guidance to pre-hospital personnel.	1 2 3 4 5
4. Inter-hospital transfer neonatal ICU patients.	1 2 3 4 5
5. Determining if a person had a cerebral stroke.	1 2 3 4 5
6. Making on-site or in-transit clinical diagnoses.	1 2 3 4 5
7. Recommending whether a patient should be intubated.	1 2 3 4 5
8. Determining if a patient had a pneumothroax.	1 2 3 4 5
9. Assessing state of injury of a motor vehicle crash victim.	1 2 3 4 5
10. Determining whether a person could be declared dead.	1 2 3 4 5
11. The surveillance camera (B&W) video was useful.	1 2 3 4 5
12. The mobile slow video image review capability was best.	1 2 3 4 5
13. Hearing audio of field care providers is helpful.	1 2 3 4 5

II. The still images of the LAD Demo (http://nsc.umaryland.edu):

1. Provide me with additional information not noted during slow video.	1 2 3 4 5
2. Clarity of the still images increased my understanding of slow video events.	1 2 3 4 5
3. The combination of still images and slow video would be best.	1 2 3 4 5
4. The size of the thumb-nail images on the website is ok.	1 2 3 4 5
5. I would prefer all the images to be larger.	1 2 3 4 5
6. I would like to be able to click on and enlarge selected images.	1 2 3 4 5
7. Images in color conveyed more than black and white (B&W).	1 2 3 4 5

III. Thank you for your participation

I am (check): ☐ Medical ☐ Police ☐ Fire Department ☐ Military ☒ Civil Defense ☐ Other: ____________

Please return to Colin Mackenzie via fax to (USA) 410-328-2841 or email to cmack003@umaryland.edu or mail to National Study Center for Trauma and EMS, 701 W. Pratt Street, 5th Fl. Baltimore, Maryland 21201.

Remote Observation LAD Demo
March 26, 2004

Answer Sheet Number: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Time Completed: ____ hours ____minutes

I am: (check) ☐Medical ☐Police ☐Fire Department ☐Military ☐Civil Defense ☐Other

1) I would predict this event will be physically affecting a population of

   Circle: <5 6-10 11-30 31-100 101-500 >500

2) List the most recent decisions made by those seen on the images displayed. (List up to three most important decisions, in order of decreasing importance.)

   Decision 1______________________________
   Decision 2______________________________
   Decision 3______________________________

3) At the moment, the following is unclear to me (List up to three most important, specific areas in the order of decreasing importance):

   Unclear 1______________________________
   Unclear 2______________________________
   Unclear 3______________________________

4) How I would describe the Emergency Team Activities. (List up to three most important, descriptors, in order of decreasing importance.

   Activities 1______________________________
   Activities 2______________________________
   Activities 3______________________________

5) I anticipate the following immediate problems (List up to three most important, specific problems, in order of decreasing importance:

   Problems 1______________________________
   Problems 2______________________________
   Problems 3______________________________

Remote Observation LAD Demo
March 26, 2004

6) List in priority the three current most important objectives of the Emergency Management Team. List your instructions to achieve objectives.

Objectives 1____
Objectives 2____
Objectives 3____

Instructions 1____
Instructions 2____
Instructions 3____

7) List in priority three most important pieces of information you would like to obtain and why.

Information Needed 1_____________________________________
Information Needed 2_____________________________________
Information Needed 3_____________________________________

Reason Why Needed 1____________________________________
Reason Why Needed 2____________________________________
Reason Why Needed 3____________________________________

8) **Circle** your response to the following statements:

	Disagree				**Agree**
I am comfortable giving instructions to the team	1	2	3	4	5
Given the opportunity, I would obtain more information	1	2	3	4	5
I know the tasks being carried out by the team	1	2	3	4	5

9) Circle your probability estimate of a major clean-up.

Lowest				**Highest**
1	2	3	4	5

10) Other comments.

20 RECOMMENDATIONS FROM LAD DEMONSTRATION EXERCISE

PROBLEM	RECOMMENDATION	RATIONALE
1. Voice radiation sensor alarm message unclear and too short	Message should be repeated several times, not once, and should be more comprehensive	Message was not understood by operator who received call.
2. Exercise of Incident Command by first on scene	Follows EM Plan which states first on scene is Incident Commander	Need information to be passed up chain of command directly
3. Failure of robot-radiation sensor analyze/peak measure mode	Test and re-evaluate Robot remote radiation sensor detection analyze/peak function mode to correct cause or failure in LAD Demo.	Robot was unable to function to prescribed capability when operating wirelessly. Did function better when tethered to fiber optic cable.
4. Walking worried (WW) meeting point locked. Counselors unable to get to Incident Command (IC).	Coordinate WW meeting point with campus counselor (CC). Counselors need some identification to notify IC and cordon keepers that they are there to help. CC should kept better informed and have just one job/have help	Counselors were turned away from cordon. WW meeting point was locked and occupied by another group
5. Radio Communication Failure between Hospital and Campus EOC (PSG) due to two incorrectly re-programmed hand held radios	Re-programmed radios should be checked systematically. All emergency radios should be operational. Call back check from key players (i.e. UMMC/Campus) by pre-determined protocol.	The Hospital Disaster Planner was given an incorrectly programmed radio-so breakdown of critical communication pathway occurred.
6. Drill Controllers spent a lot of time calling evaluators/observers	Audio transmission via an IC radio to drill controllers would have greatly augmented mobile and fixed images. Have communication to drill controllers as a routine safety check to confirm "injects" carried out	Audio with the images would have saved drill controllers from making so many calls and would have increased safety should a real event have occurred during the drill.

PROBLEM	RECOMMENDATION	RATIONALE
7. Incident Command (IC) close to Bomb site	IC should be remote from bomb location (limitation of drill site, in reality would have been further away)	IC was so near bomb that all would have been injured if it exploded.
8. TV stations have no policies in place	Send VAMHC policy on how to respond to phoned in bomb threats to TV stations as they have no policies in place.	Useful information may be obtained when bomb threat called in
9. Communication dead spots on campus	EOC for Campus should be in a place where cell phones can send and receive signals and pagers, email and wireless technology radios work – requires signal booster technologies for EOC to avoid communication dead spots.	Cell phones are a common form of emergency communication. All communication modalities should be accessible at EOC.
10. MIEMSS was told to Shelter-in-Place after the building had been evacuated – causing confusion.	Group email should be modified to allow accommodation of different emergency plan status in different buildings. A spread sheet identifying response required in a given campus building would standardize information transfer and avoid confusion of suggestion shelter-in-place when earlier evacuation had occurred.	All buildings on campus may not have the same threat or emergency response requirement.
11. Campus Emergency Management personnel turnover	More frequent campus Exercises to ensure new personnel are trained and ensures continuity and personnel turnover.	This exercise was the first effort for Campus/City wide coordination.
12. UM Campus Police did not communicate with MIEMSS and were unaware of MIEMSS IC system	UM Campus Police should familiarize themselves with MIEMSS Emergency Management and IC System	UM Campus police have responsibility for MIEMSS a key EMS Building on Campus

PROBLEM	RECOMMENDATION	RATIONALE
13. MIEMSS floor wardens did not take paperwork to the assembly point – but left it at MIEMSS	Floor wardens should take documentation to assembly point and stay to interface with UM Campus Police & BCFD/BCPD	Need to know status of each floor occupancy after building evacuated
14. BCFD did not remain on scene at MIEMSS to pass on information	BCFD should convey information to Bomb Squad about bomb location.	Bomb Squad needs to know all they can about bomb
15. Difficult to explain building layout to people in an emergency	Floor plan of building should be provided to incoming Emergency Responders	Floor Plan can expedite situational awareness for emergencies responders.
16. Back-up EMRC near site-of Dirty Bomb. EMS personnel could not necessarily reach it.	There should be remote SARC back-up in other part of than UM Campus. Alternate use of hospital "red phones".	Disaster could strike entire campus; disabling both MIEMSS and Shock Trauma located EMRC back-up.
17. No accounting for who was in MIEMSS at time of threat detection, so unclear whether building evacuate complete.	No simple to account for who is in a building at time of threat detection. Card swipe/ID sensors on entry and exit would provide needed data.	While evacuated personnel can be recognized, those still in building may not be noted.
18. EOC on campus had difficulty contacting UMMC	Communications Exercise are required to avoid communication failure between UMMC and UM Campus	Essential that UMMC & UM Campus Emergency Response Coordinated.
19. Some communication technologies non functional at Campus EOC	"Layered" information delivery with redundancy to ensure dissemination and avoid the situation where UMMC Security staff were unaware of LAD Demo and Bomb Threat.	Internal communication failures create problems implementing emergency management plan.
20. Interoperability of communication	Alternative site to Pearl Street Garage (PSG or used standardize emergency frequencies and signal boosters to remove dead spots.	EOC needs to have optimal and interoperable communications at multiple levels including land lines, cell phones, e-mail, pagers, SW radio.

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CTR. FOR MGMT. & TECHNOLOGY	Fabian, Alan			√
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	Standley, Ernie			
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Charles McC. Mathias, Jr.
National Study Center
for Trauma and Emergency Medical Systems

UNIVERSITY OF MARYLAND SCHOOL OF MEDICINE

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ORGANIZATION	INVITEES	CONTACT INFORMATION	PHONE & EMAIL ADDRESS	RSVP
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	Tuxill, General Bruce			

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UM Student Union – Terrace Lounge

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Real-time Local Area Bio/Chem Defense System for Military & Civilian Terrorist Targets

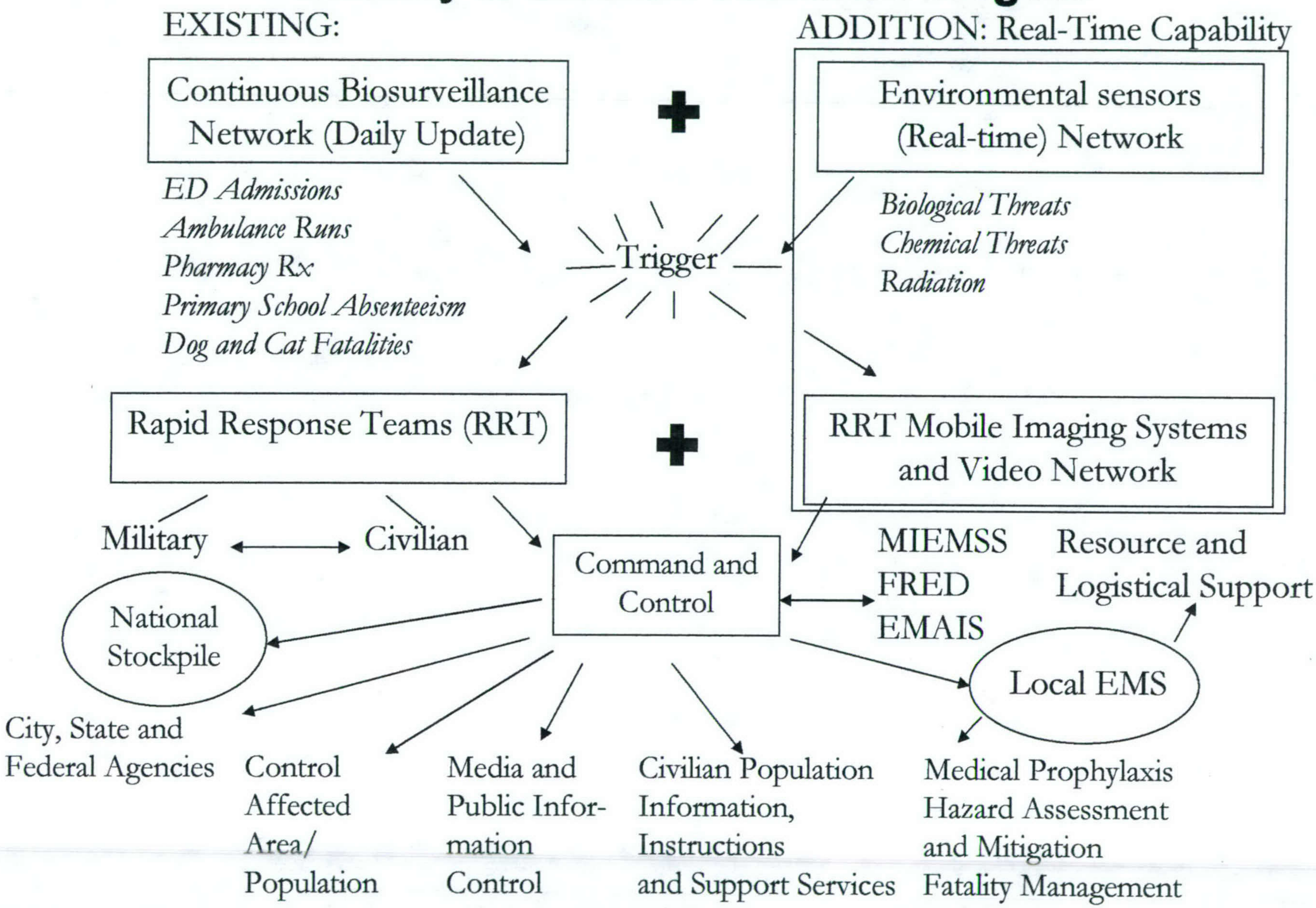

Fig 1 Addition of a Real-Time Sensor Network activates Rapid Response Team ,who use Mobile Imaging System to provide real-time Incident Management for Command &Control